

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: H. H. KIMBALL.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for May, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian service, cable and mail, 8; River and Flood service, 52, river and rainfall, 177, rainfall only, 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José,

Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is $157^{\circ} 30'$, or $10^{\circ} 30'$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^{\circ} 36' 13''$ slower than seventy-fifth meridian time, corresponding to $5^{\circ} 36'$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRETT, in charge of Forecast Division.

In the United States the weather of May, 1903, presented strikingly abnormal features. New England, and the greater part of New York, received practically no rain from the 4th until the closing days of the month. In the Middle Atlantic States an unbroken period of dry weather extended from the 4th to the 22d. Excessive rains fell in the South Atlantic States from the 6th to the 15th. In the Ohio Valley, Tennessee, the Gulf States, and the greater part of the Lake region the rainfall was abundant. In the Pacific coast States the month was unusually dry. During the last decade of the month, and more particularly from the 24th to the 27th, a succession of severe local storms, some of which developed into tornadoes, visited the States of the lower Missouri and upper Mississippi valleys. From the 19th until the close of the month excessive rains over the water sheds of the lower Missouri and upper Mississippi rivers produced floods that in the lower Missouri Valley were the most formidable that have occurred since 1844.

THE SEVERE LOCAL STORMS OF MAY 24 TO 27 IN THE MIDDLE-WESTERN STATES.

Excessive atmospheric heat and moisture are recognized factors in the production of severe local storms. The origin of storms of this character depends, therefore, upon general atmospheric conditions which promote unseasonable warmth and abnormally high humidity in the regions in which they

occur. These conditions usually develop slowly and may be detected, and even anticipated, by means of charted reports of daily meteorological observations that have been simultaneously taken over a large area surrounding the storm threatened district.

As the atmosphere receives its moisture from the water surfaces of the earth it follows that excessive humidity in the central valleys of the United States must be due principally to moisture laden air from the Atlantic or the Gulf of Mexico, and it is also apparent that these masses of air from southern latitudes possess temperatures that are higher than the average temperature of the more northern districts over which they are carried. The mechanical processes that are employed in producing a flow of warm, moist southerly winds over the interior districts of the United States obey the laws of cyclonic and anticyclonic wind circulation, and are illustrated on the daily weather maps.

General barometric conditions favorable for a persistent and strong flow of southerly winds over the Mississippi and lower Missouri valleys appeared May 15. From that date until the 27th the barometer continued low over the Rocky Mountain region and the Missouri Valley and high over the Atlantic and Pacific coast districts. During the 27th an area of low barometric pressure passed northeastward to the upper Lake region, and after that date a barometric disturbance drifted slowly eastward from the middle-eastern Rocky Mountain slope to the

middle Mississippi Valley. Rain set in over the Missouri Valley and the Northwest the night of the 16th, and continued almost uninterruptedly over the water sheds of the Missouri and upper Mississippi rivers until the close of the month. During the entire period from the 16th to the 27th the wind continued southerly and the temperature abnormally high in the Mississippi and lower Missouri valleys. Following the passage of the low area to the upper Lakes on the 27th, and the subsequent eastward movement of the low area over Kansas and Missouri the temperature fell in the lower Missouri and upper Mississippi valleys, and temperature conditions favorable for the development of severe local storms were not present in those districts during the remainder of the month.

The general weather conditions that prevailed over the United States from May 20 to 31 are shown on charts Nos. XI-XXII herewith. Rains set in over the Missouri Valley on the 16th, but the morning temperatures in that section did not favor the development of severe local storms until the 22d, when the temperature line of 70° looped northward over the Mississippi and lower Missouri valleys to the southern border of Iowa. Within the area bounded by this line thunderstorms occurred on the 22d and 23d.

The first storm of a tornadic character reported occurred in southeastern Nebraska during the afternoon of the 24th, when several persons were killed and property was destroyed in Clay, Franklin, Kearney, and Adams counties. On the 25th severe local storms, some of which were doubtless tornadoes, occurred in eastern Kansas, eastern Nebraska, and southern Iowa. In Kansas tornadoes that were attended by a number of fatalities were reported in Miami and Shawnee counties. In Nebraska the areas of maximum storm intensity appeared to be in Clay and Adams counties. In Iowa the storm belt covered the southern half of the State. On the 26th the region visited by local storms of a severer character embraced southeastern Nebraska, southwestern Iowa, and extreme northwestern Missouri. On the 28th severe and destructive thunderstorms occurred in northern Illinois, northern Indiana, and northwestern Ohio.

The devastating floods occurring over a great part of the storm visited district during the closing days of the month were, in part, coincident with the local storms under discussion, and it is impossible, therefore, to at present determine which of the agents of destruction was responsible for many of the losses reported. It is known, however, that reports of some of the storms were exaggerated, and that in instances so-called tornadoes were thunderstorms or wind squalls of unusual violence.

The tendency to exaggeration in reports of meteorological phenomena of a violent character is common and natural. In the case of local storms the destroying power of the severest thunderstorm or wind squall has about the relation to the destroying power of a tornado that the work that can be done in a specified time by a hand sickle has to the work that can be accomplished by a power reaper. The thunderstorm wrecks only frail structures; the true tornado dislodges solid masonry and mows a path through forests of sturdy trees as clean cut as that made by a reaper through a field of grain.

Estimates made in connection with the local storms of May 24 to 27 place the number of killed at about fifty, the number of injured at about sixty, and the property loss in the tens of thousands. The destruction of life and property was confined principally to eastern Nebraska and southern Iowa.

THE MAY, 1903, FLOODS IN THE LOWER MISSOURI AND UPPER MISSISSIPPI VALLEYS.

The floods in the lower Missouri and upper Mississippi valleys were due almost entirely to heavy rains in that region, snow water from the headwaters of the Missouri contributing but slightly to the flood wave. The principal streams involved

in the flood were the Missouri, Kansas or Kaw, Big Blue, Des Moines, and Mississippi, and the principal States affected were Kansas, Nebraska, Missouri, and Iowa. The main flood came from the Kansas River, which flows eastward through Kansas and joins the Missouri River at Kansas City. The loss by flood in the State of Kansas has been estimated at \$12,000,000, mostly to crops and railroads, and in North Topeka alone a number of persons were drowned and thousands were rendered homeless by fire and flood.

At Kansas City the river passed the danger line, 21 feet, on the 27th, and reached a height of 27.5 feet on the morning of the 31st. The crest of the flood was reached on June 1, when a stage of 35 feet was shown on the gage. This was 14 feet above the danger line, and but 2.0 feet below the recorded high water mark of June 20, 1844. The loss by flood at Kansas City is placed in the neighborhood of \$10,000,000. Beginning May 26 the Weather Bureau issued daily advices regarding the heavy rains and the probable effect they would have on the rivers in that vicinity.

The rainfalls of the last sixteen days of May at stations between the Mississippi River and the Rocky Mountains are indicated in the table herewith. The period of heaviest rainfalls extended from the 22d to the 31st. Among the greater amounts of rainfall reported for this 10-day period are: 8.96 inches at Des Moines, Iowa; 9.15 inches at Concordia, Kans.; 4.88 inches at Davenport, Iowa; 4.27 inches at Omaha, Nebr.; 3.61 inches at Dubuque, Iowa; 2.46 inches at Keokuk, Iowa; and 2.87 inches at Wichita, Kans. Heavy rains and destructive floods also occurred during this period in Oklahoma and Indian Territories. At Oklahoma 8.77 inches of rain fell during the last ten days of May.

June opened with the flood wave moving down the Missouri River below Kansas City, and the Mississippi River above the danger line from Keokuk to the mouth of the Missouri River. On June 1 warnings were issued that the danger line at St. Louis, 30 feet, would be reached within thirty-six hours and a stage of 34 feet attained within four days. The danger line was reached at St. Louis on the 2d, the Mississippi was above the danger line as far north as Dubuque, and between Keokuk and Hannibal was 3.5 to 4.5 feet above. Daily warnings were continued from three to four days in advance along the flooded districts of the Mississippi, and on the 6th interests in and about St. Louis were warned to prepare for a 38-foot stage. This stage was reached four days later, on June 10, and was the maximum height reached at St. Louis.

On June 5 the levee broke just below Louisiana, Mo. This levee inclosed a fertile farming region containing more than 100,000 acres, and a population of probably 10,000. The levee had not been overflowed since 1888, and the damage by the break of the present year has been estimated in the millions of dollars.

The stage at St. Louis on the 10th was 0.5 higher than the stage reached on May 19, 1858, and 3.4 below the recorded high water mark of June 28, 1844.

The damage and loss of life caused by the floods of June, 1903, along the upper Mississippi River, and along the Missouri River east of Kansas City, can not now be approximated. Conservative estimates place the damage to property and crops at many millions of dollars. Throughout the entire flood visited area all points that could be reached by telegraph, telephone, or mail were supplied with warnings accurately forecasting, from three to four days in advance, stages that would be recorded on river gages at Weather Bureau stations, and as a result of these warnings thousands of persons were enabled to remove themselves and their portable property to places of safety.

Detailed descriptions of the floods will be found under the heading "Rivers and floods," and will be published later.

Low barometric pressure prevailed over the southern por-

Daily rainfall at Weather Bureau stations between the Mississippi River and the Rocky Mountains, May 16-31, 1903.

Stations.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	Total.
Williston, N. Dak.	0.16	0.08	0.34	T.	T.	0.94	1.49	0.12	0.02	0.08	0.20	0.46	0.60	0.04	0.50	3.87	
Bismarck, N. Dak.		T.	0.86	T.		0.47	1.06		0.19	0.04	T.	0.12	T.		0.50	3.09	
Pierre, S. Dak.	0.26					0.14	0.62		0.02				0.46	T.	0.16	1.71	
Rapid City, S. Dak.	0.02	0.14	0.30	0.16		0.14	0.18	T.	0.02			T.			0.16	1.24	
Huron, S. Dak.						0.16	0.50	0.34	0.24	0.08	0.24	0.01				1.57	
Yankton, S. Dak.						0.03	T.	0.39	0.76	0.63	1.00	0.39	0.39	0.43	0.40	0.10	4.55
Miles City, Mont.	0.10	0.22	0.02			0.26	0.16	0.06					0.22			1.04	
Havre, Mont.	0.02	0.96	0.44	0.64		0.06	0.88	0.28	0.06			0.04	0.02			3.40	
Helena, Mont.	0.50	0.40	0.28	0.01		T.	T.	0.30		0.04		0.04				1.57	
St. Paul, Minn.						0.10				0.01	0.64	T.	0.62	1.04	0.24	2.65	
Moorhead, Minn.	0.04	0.30	0.60			0.24	0.42	1.50								3.10	
Valentine, Nebr.						0.26	0.24	T.	0.10	0.04	0.50		0.32	0.02		1.48	
North Platte, Nebr.		T.				0.18	0.02		0.02	0.08	0.18	0.01	0.43	0.06		0.98	
Lincoln, Nebr.	0.07	T.	0.24			0.56	0.79	0.28		1.37	1.03	0.43	0.15	1.94	1.13	8.09	
Omaha, Nebr.	0.16		0.04	0.10	0.64	0.80	0.01			0.95	0.93	0.56	T.	0.52	0.40	0.10	5.21
Concordia, Kans.	0.30	0.14	0.78	0.04		0.18	1.10	0.94		0.16	0.96	1.64	3.68	0.25	0.42	10.59	
Topeka, Kans.		T.				0.50	0.04	0.64	0.35	0.22	0.21	0.28	0.24	1.71	0.26	0.91	5.41
Wichita, Kans.	0.01		0.98	0.10		2.24	0.04	1.29	T.			0.22	0.22	0.82	0.02	0.26	6.17
Dodge, Kans.	0.14	0.10				0.10	0.58	0.06				0.30	0.26	0.28	0.03	0.04	1.89
Denver, Colo.		T.	0.01			T.	T.	T.		0.01	T.		0.01	0.03		0.28	0.34
Pueblo, Colo.												0.06	0.22	T.		0.28	
Cheyenne, Wyo.	0.10	0.06	0.10			T.	0.01		T.		T.		0.12	T.			0.39
Lander, Wyo.	0.62	T.				0.06	0.18		0.48	T.	T.	0.01	0.03			1.38	
Oklahoma, Okla.	0.58	T.	.01	T.		0.02	1.25	T.	4.06	T.	T.	0.18	3.26	0.02	T.	9.38	
Fort Worth, Tex.	T.	0.01				T.		T.		T.	T.	0.68	0.46	T.		1.15	
Abilene, Tex.	T.	0.10				T.				T.						0.10	
Amarillo, Tex.	T.					T.	0.54									0.54	
Palestine, Tex.	0.04	T.				T.						0.06	0.05	0.49	0.18		0.82
Taylor, Tex.	0.05		0.10	T.	0.02	0.02	0.30		0.49								
San Antonio, Tex.	0.55	0.01	0.02	T.	T.	0.01	T.						0.01			0.60	
Dubuque, Iowa.	0.08	T.	T.	0.01	0.06	0.50	0.02		0.10	1.40	1.11	0.02	T.	0.34	0.12	3.76	
Davenport, Iowa.		T.				0.48	0.08	0.20	0.05	0.08	0.42	0.38	0.32	2.02	0.46	5.36	
Des Moines, Iowa.	0.30	T.	0.04	0.02	0.06	1.38	0.12		0.18	2.08	1.38	0.06	0.94	2.52	0.30	9.38	
Keokuk, Iowa.	T.	0.06	T.			0.76	0.04	0.06	1.40	0.52	0.06	T.	T.	0.38		3.28	
Sioux City, Iowa.	0.02	0.72	1.08			0.88	0.24	0.02	0.01	0.47			2.27	0.42	0.08	6.21	
Kansas City, Mo.	0.02		0.06	T.	0.70	0.34	0.74	0.24	0.02			0.76	0.01	0.23	0.68	1.08	
St. Louis, Mo.		0.16	0.04	0.40	0.06		T.	0.01	T.			0.12		0.40	T.	0.42	
Springfield, Mo.	T.	0.04	0.02	0.70	1.06	0.35			0.06	T.	T.	0.20	0.80	1.54	1.66	6.43	
Hannibal, Mo.	T.	0.17	0.02			0.49		T.	0.04	1.93	0.06	T.	0.04	0.28	0.32	1.61	
Fort Smith, Ark.	T.	0.03	T.	1.36	T.					T.	0.22	0.02	1.96	0.12	0.44	4.15	
Little Rock, Ark.	T.	T.	0.54	T.						T.	1.14	0.68	0.91	T.		3.27	
Shreveport, La.	T.	T.	T.							T.	0.02			T.	0.06	0.08	

tion of the British Isles during the first decade of the month, and from the 13th to the 16th and 20th to the 24th barometric disturbances were central near the north of Scotland. From the 25th to the 27th the barometer was high over the British Isles.

Storms of marked severity were not reported on the North Atlantic Ocean nor on the Atlantic and Gulf coasts, the Great Lakes, and the north Pacific coast of the United States. On the California coast high northwest winds prevailed during the latter half of the month.

BOSTON FORECAST DISTRICT.

Except the severe drought, which prevailed throughout the month in all sections of the district, the weather of the month was uneventful. One storm warning was ordered on the 27th, which was fully justified along the middle and northern coast, and no storms or high winds occurred for which warnings were not issued.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

The month opened unseasonably cold, with the lowest temperatures on record during the first decade of May in some parts of the district. The forecasts issued for the above conditions on the last day of April were discussed in the report for that month. The frost on the 1st and 2d materially injured cotton in some places. Truck gardens were successfully protected. Storm warnings were issued for parts of the coast on the 10th, 16th, and 28th. Brisk to high winds occurred during the displays. As a whole, the month was unusually mild.

The river continued falling slowly during the month; it was above danger line at New Orleans until the 22d and at Melville, La., at the close of the month. As the water recedes from the overflowed districts, data are being gathered relative to the extent of the overflow and damage resulting therefrom.

Efforts to close the crevasse at Hymelia, 40 miles above New Orleans, proved unsuccessful, and the work has been abandoned. The water is receding very slowly from the over-

flowed district in the vicinity of this crevasse. Full report on the high water is being prepared as rapidly as possible.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

The Lakes were unusually free from severe storms; the only storm of consequence occurred near the end of the month, for which warnings were sent out well in advance. No casualties of note, due to stress of weather, were reported.—*H. J. Cox, Professor of Meteorology.*

SAN FRANCISCO FORECAST DISTRICT.

The month was, as a whole, exceptionally dry. At San Francisco the month was the driest since 1873, and in general this is true for a large portion of the State. Taken in connection with the dry period during the latter half of April, the result was an unfavorable period for the successful maturing of crops. An interesting question also arises as to whether a progressive easterly movement of this dry period can be traced from the Pacific coast to the Rocky Mountain region and, possibly, to the great central valley. The accompanying table of total air movements shows the extended duration of high winds along the California coast. At Point Reyes Light, Cal., for a period of nine consecutive days, the total air movement recorded was 11,223 miles, or an average hourly movement exceeding 50 miles. (See the special report on a subsequent page.)

The beginning of the month was marked by a distribution of pressure similar to that shown on Chart IV, Sea Level Pressure, MONTHLY WEATHER REVIEW, May, 1902. On May 12, 1903, a depression of moderate depth passed over Washington, Vancouver Island, and British Columbia, and for a brief period the winds on the Pacific coast were from the southeast. There was a quick reversion, however, to the type of pressure distribution first described, and for the balance of the month high northwest winds prevailed with little cessation. The total air movements for the month are as follows:

Wind movement for the month.

Stations.	Total for month.	Average daily.	Greatest in 24 hours.	Greatest hourly movement.
Point Reyes Light, Cal.	24,072	776	1,673	88
Mount Tamalpais, Cal.	16,871	544	1,189	78
San Francisco, Cal.	10,040*	324	517	34
Point Lobos, Cal.	15,431	498	929	60
Southeast Farallon, Cal.	17,331	559	1,185	58

*May, 1899, 10,346 miles.

The wind blew at a velocity equaling or exceeding 60 miles an hour for forty-three hours at Point Reyes Light, Cal., and nineteen hours at Mount Tamalpais.—*A. G. McAdie, Professor of Meteorology.*

PORTLAND, OREG., FORECAST DISTRICT.

May, 1903, in the North Pacific States, was cool and, in many places, unusually dry. Frosts, which, as a rule, were accurately forecast, occurred frequently east of the Cascade Mountains, and in consequence vegetation made slow advancement. No storm warnings were issued and there were no storms during the month.

The cool weather delayed the annual rise in the Columbia River, and at the end of the month the stream, although steadily rising, was well within its banks.—*E. A. Beals, Forecast Official.*

RIVERS AND FLOODS.

The rainfall over the Missouri and upper Mississippi water sheds was largely in excess of the usual amount during the month of May, and, as a natural consequence, high stages of water were experienced in both rivers. In the valley of the Kansas River and its tributaries the precipitation was especially heavy, averaging about seven inches above the normal amount for the month, and much the greater portion occurred during the last two weeks. The results of these unusual conditions were the great floods in the Kansas and lower Missouri, the Des Moines, and the Mississippi rivers from Keokuk to Cairo. These floods were the greatest ever known, with the exception of that of 1844, and were by far the most destructive. The stories of the losses of human lives and of the ruin and desolation at Topeka, Kans., Kansas City, Mo., and its suburbs, and at East St. Louis, Ill., are in a general way familiar to all, and need not be repeated here. The detailed histories of the floods are not yet completed and will be printed at a future time.

The rains were also exceptionally heavy in the valley of the Arkansas River, and stages above the danger lines were general from the Indian Territory to the mouth of the river. Considerable damage was done in the Territory, but none of any consequence to the eastward.

The following summaries relating to the general weather and crop conditions during May are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—The first two weeks were cool and wet; rainfall quite excessive in some eastern and west-central counties; considerable riverland corn drowned. The last two weeks were comparatively warm and dry. Much cotton and corn replanted, owing to damage by cold; at close of the month cotton was small and two to three weeks behind last year; corn also late, but both crops were improving slowly; worms damaged corn considerably, particularly on lowlands.—*F. P. Chaffee.*

Along the remaining rivers of the country conditions were quiet, with but a single incident or two worthy of special mention. In the navigable rivers the stages were all that could be desired for purposes of transportation by water. Heavy rains on the 14th and 15th over the Southern States caused moderate floods in the rivers of Alabama and lower Georgia. Warnings were issued in due time, and very little damage was done by the waters. All that has been reported was the flooding of some lowland corn along the Alabama River, necessitating replanting.

The annual rise of the Columbia River began on the 16th, and warnings of danger-line stages by the 21st were issued at Portland, Oreg.

The highest and lowest water, mean stage, and monthly range at 159 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.		Last observed.		Path.		Average velocity.		
	Date.	Lat. N.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
I. High areas.	o	o	o	o	Miles.	Days.	Miles.	Miles.	
I.	1, p. m.	48	123	5, a. m.	48	68	3,200	3.5	914 38.1
II.	5, a. m.	50	100	9, p. m.	46	60	2,475	4.5	550 22.9
III.	10, a. m.	50	100	12, a. m.	48	68	1,550	2.0	775 32.3
IV.	10, a. m.	41	124	13, a. m.	48	86	2,675	3.0	892 37.2
Sums.						9,900	13.0	3,131	130.5
Mean of 4 paths.						2,475		783	32.6
Mean of 13.0 days.								762	31.8
Low areas.									
I.	4, p. m.	33	112	11, p. m.	27	80	2,450	7.0	350 14.6
II.	8, p. m.	33	112	15, p. m.	27	80	2,700	7.0	386 16.1
III.	16, a. m.	37	114	21, a. m.	50	64	3,450	5.0	690 28.8
IV.	19, p. m.	37	118	23, p. m.	50	100	1,625	4.0	406 16.9
V.	21, a. m.	52	121				1,200	2.5	480 20.0
V.	23, a. m.	35	112	29, a. m.	50	64	2,950	4.0	738 30.8
VI.	27, p. m.	32	107	*1, p. m.	38	90	1,600	5.0	320 13.3
Sums.						15,975	34.5	3,370	140.5
Mean of 7 paths.						2,282		481	20.1
Mean of 34.5 days.								463	19.3

*June.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*George E. Hunt, Chief Clerk, Forecast Division.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Division.

Arizona.—During the first half of the month the weather was warm, but the latter half was cold, except for a few days at the end of the month. Heavy and damaging frosts occurred during the latter half of the second and the first half of the third decades in the colder portions of the Territory, but no frosts occurred in the more important agricultural valleys. The precipitation for the month was about normal; irrigation water was generally sufficient for the needs of vegetation, but it was deficient in some localities. Except where damaged by frost, crops did well. Fair to very good crops of grain were harvested in the more important agricultural valleys. The second crop of alfalfa began to be harvested in Maricopa County and the third in the lower Colorado Valley. The fruit crop was very good. Ranges afforded good grazing and cattle were in good condition.—*M. E. Blystone.*

Arkansas.—The first of the month was cool with general rains, which improved crops. Toward the close of the month warmer weather and

continued rains further advanced crops, but prevented cultivation, and at the close of the month all crops were grassy. Considerable cotton and corn were replanted; by the end of the month cotton chopping and cultivation of corn were general. Wheat and oats improved steadily, but did not promise good yields. Potatoes and gardens made steady improvement and good yields of potatoes were indicated. Frost injured all kinds of fruit and the yield will be short.—*Edward B. Richards.*

California.—Deficient rainfall and drying winds were unfavorable for grain and hay. The first of the barley crop was received at Stockton on the 29th; it was light and poor in quality. Haying was in progress. Deciduous fruits and grapes give indications of large crops.—*Alexander G. McAdie.*

Colorado.—The weather was too cool for normal advancement in crops, and prior to the closing days droughty conditions prevailed east of the Continental Divide, with a scarcity of water for irrigation. Small grain made slow but favorable progress. Corn showed a good stand but slow growth; potatoes, on the other hand, did well. Owing to damage by frost at the close of April much replanting of sugar beets was necessary; good stands were obtained and the crop as a whole made favorable progress. In western counties the outlook continued promising for apples, pears, plums, and cherries, and fair for apricots and peaches. Ranges were generally poor, and stock showed little improvement prior to the heavy rains of the last decade.—*F. H. Brandenburg.*

Florida.—The temperature was lower than the average, with precipitation above the normal over the northern, central, and western districts, but deficient over the southern portion of the State. Rain was sufficient and fairly general during the second decade, the weather being dry during the other decades. During the greater portion of the month cool nights retarded the growth of cotton and corn, the stands of which were only fair, although warmer weather toward the last of the month improved all crops. Large shipments of pineapples were made, and peaches, melons, and cantaloupes were plentiful; citrus trees are in good condition.—*A. J. Mitchell.*

Georgia.—The weather during the first half of the month was cooler than usual and rain was prevalent. During the latter half of the month the temperature was generally seasonable and rainfall deficient; the rainfall for the month was excessive in numerous southern localities. Heavy hailstorms occurred in Jefferson and Putnam counties on the 3d and in portions of Thomas County on the 4th. Heavy rainfall and lack of high temperature and sunshine in the majority of sections were detrimental to crops. Cotton is very backward; wheat and spring oats inferior; fall oats fair to good; corn under size; sugar cane excellent. The yield of peaches is expected to be below average, but a good quantity of fruit is indicated.—*J. B. Marbury.*

Idaho.—Temperature and precipitation were somewhat below the normal; the deficiency in precipitation being principally confined to western and northern counties, the "dry farming" districts of the eastern counties receiving sufficient moisture for crop growth. Light frosts occurred frequently, being severe in localities about the 19th to the 21st, but in general the fruit crop escaped material injury. The month closed with unusually high temperature over the western districts.—*S. M. Blandford.*

Illinois.—The month opened unfavorably. Frost of damaging effect on fruits and tender vegetation occurred on the morning of the 1st. Adverse conditions for seeding, germination, plowing, and general farm work continued throughout the first and second decades. The ground was breaking in such hard and cloddy condition as to render planting of corn very difficult. Much needed rain occurred during the third decade. The ground was softened and wheat, corn, and grasses were greatly benefited. At close of the month much corn remained unplanted.—*Wm. G. Burns.*

Indiana.—First decade cool and dry, with frosts, damaging to fruits and tender plants, as late as 8th. Sowing of oats completed and corn planting progressed, but ground baked and cloddy. Drought continued through second decade, and vegetation made slow growth; corn planting was suspended. Rain during last week of month, ground too wet to work, planting corn unfinished; oats uneven and thin; wheat, clover, and timothy short but improving.—*W. T. Blythe.*

Iowa.—The month as a whole was unfavorable for field work, the average rainfall being double the normal amount. From the 3d to the 19th conditions were at their best, and during that period the best progress was made in plowing and planting corn. The last decade brought very heavy rains and floods and work was generally suspended. The best conditions prevailed in eastern districts. Corn was about two-thirds planted at close of month, with much replanting necessitated.—*John R. Sage.*

Kansas.—A cool, very wet May, greatly retarding farm work, and in some counties completely paralyzing it. Wheat in good condition, began heading in south the first of week, in central counties the second, and northern the third. Corn growth was slow; it needed sunshine and cultivation; much has been washed out, much replanting to do; much corn land still unplanted. Oats and grass rank. Alfalfa doing well, ready to cut. Potatoes improving. Early apples, peaches, and cherries greatly damaged by cold first of month; late cherries doing well, and apples fairly well.—*T. B. Jennings.*

Kentucky.—The first week was very cool, and frosts were reported in

many localities on the 1st and 2d. Considerable damage was done to tender vegetables, but the extent of the injury was not great. The temperature soon rose and was above normal the remaining three weeks. The rainfall was light until the 27th, and some localities in the eastern and central sections were suffering from drought. From the 27th to the 31st copious rains occurred, greatly improving crop conditions. The outlook at the close of the month was quite promising.—*H. B. Hersey.*

Louisiana.—The weather of the month was not altogether favorable for agricultural interests. Low temperatures during the first and second decades retarded germination of seed and growth of vegetation, but warmer weather during the last ten days of the month proved more favorable. After much replanting fair stands of cotton secured in most sections, but the crop is generally two to three weeks behind average seasons. Fall plant and stubble cane were, as a rule, doing nicely at the close of the month, but spring plant was not growing well. Good stands of rice were secured where irrigation was available, otherwise conditions are not satisfactory. Corn improved materially. Trucking interests were not up to the average.—*I. M. Cline.*

Maryland and Delaware.—Unbroken drought from the 5th to the 22d hurt all crops. Wheat withstood the dry weather fairly well, but oats and grasses suffered, while plowing, corn planting, transplanting of tobacco, and general trucking were greatly delayed. All growth revived when rains came, but strawberries and peas had already been cut short and the prospective hay crop much reduced. Of the fruit crops, apples alone are promising.—*Edward C. Easton.*

Michigan.—Killing frosts on first and second damaged peaches and early cherries to a large extent; some damage to young clover was also reported. The first half of month was quite droughty, particularly in the lower peninsula. Showers nearly sufficient for immediate needs fell in all sections of the State after the 18th and drought was almost entirely relieved at close of month. Upon the whole, wheat, rye, meadows, pastures, oats, barley, and peas made fair growth after the 20th. By end of month corn and sugar beets had been mostly planted; both germinated nicely and were in promising condition. Early potatoes were mostly planted by the 15th and made good growth. Plowing for beans and late corn was delayed on account of dry soil until the 25th. The outlook for apples, pears, plums, and small fruits was encouraging at close of month.—*C. F. Schneider.*

Minnesota.—In the Red River Valley the month was dry and favorable for seeding an unusually large area; in southern Minnesota it was wet after the middle of the month, with rivers and creeks overflowed, low lands flooded and level lands wet, causing considerable delay to planting corn and potatoes, and some loss to small grains and sugar beets. Spring wheat seeding finished by the 15th, and oat, barley, and flax seeding well advanced. Higher temperatures after the 15th favored rapid growth of small grains, grasses, and potatoes, but corn was backward.—*T. S. Outran.*

Mississippi.—Unusually low temperatures first half of month were very unfavorable to germination and growth of cotton; much replanting was done and by close of month stands were generally good and chopping was in full progress, except in overflowed districts, where cut worms were very destructive and replanting continued. Corn generally did fairly well, and the early planted was being laid by. Oat harvest was begun, the yield being poor to fair. Sugar cane did well. Melons were late. Gardens and early Irish potatoes yielded well. Early peaches made a fair yield south. Apples were promising.—*W. S. Belden.*

Missouri.—The month was generally unfavorable for planting and cultivation. Corn ground broke up cloddy and in western sections planting was greatly retarded by rains. There was considerable complaint of poor stands; latter part of month the crop suffered for cultivation. Wheat continued promising in northern counties, but elsewhere was greatly damaged by rust, insects, and unfavorable weather. Oats and grasses did well. Freezing temperature occurred over nearly the entire State on the 1st, greatly damaging fruit. Much damage was done in the northern sections by floods in latter part of the month.—*A. E. Hackett.*

Montana.—The first two weeks were very dry; during the remainder of the month snows and rains were of frequent occurrence and placed the soil in a fairly moist condition, but cold weather retarded farm work and crop growth. Frosts occurred frequently and in some localities damaged alfalfa and wheat, but, as a rule, winter grain was in fair condition at the end of the month; forage crops and ranges gave promise of considerable improvement; the greater portion of the spring grain crops had been sown and the seeding of minor crops was in progress.—*Montrose W. Hayes.*

Nebraska.—The cool, wet weather was very favorable for the growth of wheat, oats, and grass, but the excessive precipitation retarded farm work. Corn planting progressed very slowly during the first three weeks and practically no progress was made during the last ten days; this left considerable corn to plant in June. Early planted corn came up nicely, grew slowly, and needed cultivation badly. Heavy rain last of month injured corn by washing and damaged wheat and oats in a comparatively small acreage in lowlands.—*G. A. Loveland.*

Nevada.—The weather conditions during the month were generally favorable to farming interests. Temperature and precipitation were both slightly below normal. Crops of all kinds made fairly good growth and at the close of the month were in excellent condition. Frosts during

the middle of the month did considerable damage to fruit blossoms in Nye County.—*J. H. Smith.*

New England.—Weather warm and extremely dry. Total precipitation at Boston 0.32 of an inch; lowest for May at Boston in records of the station and lowest for any month, except 0.31 of an inch in September, 1884. The drought very materially affected all crops, and especially hay, which is a very light crop; all vegetation was at a standstill and soil too dry for cultivation and for germination of seeds.—*J. W. Smith.*

New Jersey.—The prevailing weather conditions of the month were moderately warm days, cool nights, and a great deficiency of rainfall. Abnormally high temperature prevailed from the 18th to 21st, when 90° and above were recorded. The last killing frost occurred at all stations on the 2d. The long drought has seriously affected all vegetation and greatly delayed plowing, the ground being very hard and dry; much corn yet to plant.—*Edward W. McGann.*

New Mexico.—Unusually dry, cold, and windy. Vegetation very backward; drought one of the severest in years in northeastern sections. Stock ranges bare of grass, but stock in fair condition. The lambing season resulted in a very fair increase.—*R. M. Hardinge.*

New York.—Snow flurries on May 1 and killing frosts on the 2d. Light frosts also occurred in places on the 30th and 31st. The most severe drought in fifty years or more continued throughout the month, no beneficial rains fell over a large portion of State in eight weeks. Hay was practically ruined, and wheat, rye, oats, and barley seriously damaged. Apples generally promising; other fruit light. Planting corn and potatoes not finished, and much to be replanted.—*R. G. Allen.*

North Carolina.—The first half of May was below the normal in temperature and quite unfavorable for the rapid growth of vegetation; light frost occurred on the 5th in the extreme west. The dry weather at first was favorable for farm work, which began to make more rapid progress, but the spring drought soon became of unusual duration, accompanied by a period of intense heat from the 18th to the 24th, and completely checked the growth of crops. At many places there were from twenty to thirty consecutive days without more than a trace of precipitation. Most of the corn and cotton crops was planted, but both came up very irregularly; transplanting tobacco was much delayed; wheat and oats did not improve materially. Prospects for fruit, especially apples, fairly promising. General improvement took place with favorable showers near close of month, but crops are very backward and inferior.—*C. F. von Herrmann.*

North Dakota.—The month was generally favorable for farm work and growth of vegetation. The first part was cool, with light showers and killing frosts, but no vegetation was sufficiently advanced to be harmed. It was quite warm during the middle of the month, followed by heavy rains in all sections, which caused rapid germination and subsequent vigorous growth of crops, which at the close of the month were in excellent condition.—*B. H. Bronson.*

Ohio.—Wheat is heading rather short, and there is much complaint of rust in the southwest, and its condition continues good in north and east; corn planting was delayed by the drought, but considerable progress was made during the last week of the month. Oats were short but improving; potatoes, gardens, and tobacco were doing well; peaches not promising, leaf curl reported in central and northern districts; many apples blown off by high winds.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The decidedly low temperature on the first day of the month caused all early crops, vegetables, and fruit to suffer serious damage, but the favorable weather that followed aided their recovery to a large extent; excessive rains of the 23d and 28th caused floods that destroyed bottom land crops; hailstorms during the last ten days of the month damaged growing crops and fruit trees in localities; wheat, oats, rye, alfalfa, and grass made good growths; corn was cultivated once but was weedy, and only a fair stand at the close of the month; cotton was very backward, many fields were planted the second and third time; kaffir corn, broom corn, barley, cane, and millet are doing well; the hay prospect is very good; alfalfa was being cut with good yields; potatoes, gardens, and fruit are in good condition.—*Charles M. Strong.*

Oregon.—The month was cool, and in some sections unusually dry. Frosts occurred frequently east of the Cascade Mountains, and in consequence vegetation made slow advancement. Fall and spring sown grain are very backward, and at the close of the month vegetation in general was badly in need of rain. Hops that came up grew nicely, but quite a number of yards were abandoned, owing to the great number of missing hills. Fruit prospects, except peaches, continue promising.—*Edward A. Beals.*

Pennsylvania.—The average precipitation was only 37 per cent of the normal and the least for any similar period in the history of this service. Destructive frosts on the 1st and 2d. Drought conditions seriously retarded the advancement of winter grains and grasses, plowing, seeding, planting, and germination. Practically all crops in unsatisfactory condition at the close of the month and copious showers and sunshine needed.—*T. F. Townsend.*

Porto Rico.—At the beginning of the month plants were not prepared to resist the severe conditions which existed from the 1st to the 19th, and there was rapid deterioration of crops in general; in many places the small crops and ground provisions were entirely lost. Farming operations, excepting such as pertained to the harvesting of cane, were necessarily suspended. Pasturage and stock water became alarmingly

scarce. A hot wave of unusual intensity was experienced during the second decade. Quite general and copious rains set in on the 19th and continued almost daily to the end of the month, thus relieving the intense situation. Coffee crop promising. Cotton doing well.—*William H. Alexander.*

South Carolina.—The first half of May was dry and cool, with excessive cloudiness, and the last was warm and dry in the western and northern counties, but with ample precipitation in the central, southern, and eastern counties. During the first period crops were unfavorably affected, especially cotton, corn, and tobacco. The second period was more favorable and replanted fields came up to full stands. There was more than the usual amount of replanting done. There was a marked improvement in oats and a slight one in wheat. The former began to ripen and some was harvested. The fruit prospects were not impaired and early peaches were marketed. The season is backward for the staple crops and as far advanced as usual for the minor ones.—*J. W. Bauer.*

South Dakota.—Small grains, seeding of which ended early in the month, generally made very satisfactory progress, spring wheat attaining very promising condition. Heavy rains delayed corn planting on lowlands in the extreme southeastern section, but elsewhere planting was nearly finished and the early planted generally up by the 31st; poor seed and wet soil necessitated some replanting. Grass afforded good pasture. Potato planting was nearly finished and the early planted grew nicely. Flax seeding progressed favorably.—*S. W. Glenn.*

Tennessee.—Excepting the abnormally low temperature of the first few days and the heavy rains near the end of the month, the weather was favorable for farming operations and for the growth of crops. Tobacco was set out generally under favorable conditions. At the close of the month cotton and corn showed good stands, as a rule. Wheat and oats had improved, and Irish potatoes and garden truck were doing well. The prospect for apples was fairly good, but poor for peaches.—*H. C. Bate.*

Texas.—Heavy frost occurred over the northern portion of the State on the morning of the 1st; cotton on lowlands was killed and had to be replanted; corn was cut to the ground, but came up again. The first part of the month was too cool for plant growth, but the temperature conditions of the latter half were more favorable. Moderate showers were general the latter part of the first decade, but rainfall was scattered and too light to be of much service the remainder of the month. Cotton continued very backward throughout the month; replanting was generally completed, but on the whole only fair stands were secured. Corn made rapid growth, and at the close of the month the early planted was tasseling as far north as the central counties. Both corn and cotton fields were kept in an excellent state of cultivation. Wheat, rye, and oats improved steadily, and were being harvested the latter part of the month.—*L. H. Murdoch.*

Utah.—Seasonable weather prevailed during the fore part of the month, but the latter part was remarkable for abnormally low temperatures and excessive precipitation. Spring wheat and oats were in good condition. Fall wheat is generally poor, although some improvement in this crop has been noted. Alfalfa made a rapid growth. Early sown beets were being thinned out, and the late sown were coming up rapidly. Fruit prospects were fair. The damage to the buds was found to have been greatly over estimated.—*R. J. Hyatt.*

Virginia.—Crop conditions throughout the month were variable. During the first and second decades the weather was dry and vegetation began to suffer. By the 23d crops were in poor condition, but fortunately a period of rainy weather set in at this time, which continued without intermission until the end of the month. Vegetation responded quickly to the changed conditions, and finished the month much improved, particularly, corn, pastures, mowing lands, and gardens.—*Edward A. Evans.*

Washington.—Although the mean temperature was but little below the normal, and the rainfall deficient, there was a general impression that the month was unusually cool and wet. The slow growth of vegetation was due to frequent frosts and the lack of real warm weather until the last week of the month. Crops were already backward at the beginning of the month, and the weather was not such as to give them the necessary impetus. Wheat, oats, barley, and vegetables began to thrive during the last week.—*G. N. Salisbury.*

West Virginia.—The lack of rain during the first three weeks of May had a very unfavorable effect upon vegetation, and the crops were threatened with material injury. Farm work was also retarded by the baked condition of the ground. The drought was finally broken on the 22d by copious showers, which continued during the rest of the month. At the close of May wheat and rye were heading and promising, oats were improving, pastures and meadows were making rapid growth, gardens were doing well, corn was coming up nicely, planting was nearly completed, and plowing was being pushed; there was little prospect of fruit, except a few apples and berries.—*E. C. Vose.*

Wisconsin.—Completion of seeding spring wheat, oats, and barley was delayed by heavy and continuous rains and early seedlings germinated poorly. Little progress was made in preparing ground for corn and potatoes. Winter wheat, rye, clover, and timothy made excellent progress and gave promise of heavy crops. Strawberries, plums, cherries, and currants were injured to some extent by freezing weather early in the

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest

and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of Temperature and Precipitation by Sections, May, 1903.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.										
	Section average.	Departure from the normal.	Monthly extremes.				Section average.	Departure from the normal.	Greatest monthly.				Least monthly.		Station.	Amount.			
			Station.	Highest.	Date.	Station.			Station.	Amount.	Station.	Amount.	Station.	Amount.					
Alabama	69.6	-1.6	Decatur	98	23	Haleyville, Riverton	34	1,5	6.05	+2.86	Greensboro	14.81	Citronelle	2.71					
Arizona	68.6	-3.2	Mohawk Summit	115	30	Ashfork	12	20	0.22	+0.01	Flagstaff	1.35	11 stations	0.00					
Arkansas	67.4	-2.5	Pocahontas	96	23	Pond	24	1	7.47	+2.36	Mossville	14.88	Blanchard	2.34					
California	63.5	+0.3	Imperial	118	13	Bodie	8	18	0.14	-0.99	Redding	2.29	90 stations	0.00					
Colorado	51.1	-2.9	Blaine	93	21	Breckenridge	-2	5	1.09	-1.07	Ruby	4.80	Garnett, Salida	T.					
Florida	73.7	-1.9	Orange City	101	26	Quincy	49	1	5.36	+1.41	Middleburg	18.01	Myers	0.71					
Georgia	70.3	-1.3	Douglas, Quitman	103	25	Diamond	39	29	5.47	+2.39	St. Marys	18.46	Elberton	2.12					
Idaho	51.3	-1.7	Lewiston	102	31	Ramsey	39	54			Grangeville	3.73	Soldier	0.32					
Illinois	65.3	+2.1	New Burnside	93	23	3 stations	24	1	3.20	-0.85	Cambridge	7.03	Palestine	0.52					
Indiana	65.4	+2.5	Madison	93	22	Bluffton	24	4	3.15	-0.70	Northfield	7.75	Holland	0.88					
Iowa	61.6	+1.4	Rome	93	24	Bedford, Earlham	20	1,3	8.55	+4.52	Thurman	15.45	Fort Madison	2.88					
Kansas	62.4	-2.0	Garden City	92	20	Madison	20	1	8.57	+4.46	Salina	17.34	Garden City	1.49					
Kentucky	68.0	+1.8	Alpha	98	23	Fords Ferry	29	1	3.09	-0.60	Hopkinsville	6.18	Taylorsville	0.52					
Louisiana	71.8	-2.4	St. Francisville	98	25	Oxford	30	3	2.62	-0.60	Liberty Hill	5.97	Reserve	0.92					
Maryland and Delaware	64.0	+1.0	Darlington, Md	97	20	Deer Park, Md	24	2	2.58	-1.26	Bachmans Valley, Md .	4.78	Denton, Md	0.35					
Michigan	56.4	+2.0	Clinton	92	17	Iron River	10	1	2.77	-0.57	Ishpeming	8.71	Mancelona	0.50					
Minnesota	55.7	+0.9	3 stations	86	15,16	Floodwood, Mt. Iron	11	1	5.37	+2.13	Worthington	12.68	Hallock	2.39					
Mississippi	70.7	-1.8	Aberdeen	98	28,30	Duck Hill	34	2	3.90	+0.81	Agricultural College .	8.33	McNeill	1.36					
Missouri	65.1	0.0	New Haven, St. Louis	92	22	Montreal	23	1	7.10	+2.10	Rockport	14.01	St. Louis	2.08					
Montana	49.0	-4.2	Glasgow	98	13	Livingston	10	18	2.14	-0.26	Glasgow	5.35	Hayden	0.35					
Nebraska	58.4	-1.2	Culbertson	98	14	Halsey	91	20	7.27	+3.62	Bradshaw	17.22	Kimball	1.56					
Nevada	54.1	-2.1	Tecumseh	91	24	Fort Robinson	16	1	7.27	+3.62	Hamilton	2.92	5 stations	0.00					
New England*	57.3	+2.0	Hartford, Norwalk, Conn	96	20	Potts	106	30	0.70	-0.30	Eastport, Me	2.52	Burlington, Vt	T.					
New Jersey	62.7	+2.3	Paterson	98	20	Layton	21	2	0.59	-3.65	Cape May, C. H	1.32	Blairstown	0.08					
New Mexico	58.3	-1.7	Carlshad, Raton	99	18,25	Raton	18	1	0.44	-0.57	Eagle Rock Ranch	1.55	3 stations	T.					
New York	58.3	+2.4	Oyster Bay	95	18,20	Paul Smith	95	10	2	0.67	Wappingers Falls	5.92	Bouckville	0.00					
North Carolina	67.3	+0.2	Primrose	95	20	Salisbury	100	23	Linville	26	5	1.99	-2.21	Highlands	6.44	Plattsburg	0.00		
North Dakota	54.3	+3.0	Medora	96	14	Mayville	96	14	11	1	3.12	+0.70	Oakdale	7.83	Rockingham	0.44			
Ohio	63.9	+2.4	3 stations	93	17	New Bremen	22	4	2.82	-0.72	Waverly	6.35	Mayville	1.17					
Oklahoma and Indian Territories	65.8	-3.2	Durant, I. T	100	27	3 stations	24	1,2	7.33	+1.57	Blackburn, Okla	17.29	Cleveland	1.22					
Oregon	54.7	-0.2	Coyote	105	30	Grass Valley	11	70	1.52	-1.09	Glenora	7.55	Eldorado, Okla	0.01					
Pennsylvania	61.8	+2.3	3 stations	94	17,19	Bend	11	16			Bialock	T.							
Porto Rico	78.3	-	Hacienda Perla	99	16	Dushore	18	2	1.67	-2.76	Aleppo	4.65	2 stations	0.22					
South Carolina	70.7	-0.9	Sumter	104	25	Barros	48	3	5.82	-3.74	Isabela	12.08	Coamo	0.21					
South Dakota	57.9	-0.5	Bowdle	99	15	Heath Springs	44	12	2.69	-0.67	Beaufort	11.97	Liberty	0.25					
Tennessee	67.7	+0.4	Maryville	95	23	Due West	44	25	3.99	+1.10	Tyndall	11.47	Howell	0.79					
Texas	69.6	-3.3	Fort McIntosh	99	30	Rugby	30	58	4.76	+1.12	Dickson	9.31	Bluff City	0.86					
Utah	63.3	-3.4	St. George	101	14	Pope	30	35	2.29	-2.39	Sonora	5.76	El Paso	0.29					
Virginia	65.0	+0.4	Columbia	99	21	McKinney, Menardville	27	1			Ogden	4.34	Aneth	0.12					
Washington	54.5	-1.0	Pasco	105	30	Grass Valley	15	17	1.60	+0.79	Bedford City	5.80	Lillydale Station	0.77					
West Virginia	64.3	+1.7	Byrne	95	27	Burkes Garden	28	22	2.39	-1.98	Barbourville	8.04	Racine	2.39					
Wisconsin	56.7	+1.5	Racine	90	19	Odessa	20	7	1.85	-0.47	Clearwater	6.24	Cheyenne	0.46					
Wyoming	47.2	-4.0	Basin	93	14	Travellers Repose	20	2	3.03	-1.26	Buchanan	8.88	Trinidad	T.					

* Me., N. H., Vt., Mass., R. I., Conn.

month. Cranberry marshes were generally drained about the middle of the month and vines found in good condition. Tobacco plants are reported in good condition.—W. M. Wilson.

Wyoming.—The showers of the month were sufficient over most sections for the needs of crops and ranges, and at the close of the month ranges were in excellent condition at almost all parts of the State. The

unusually cold weather and prevailing frosts during the entire month prevented crops from making satisfactory growth, and some alfalfa was injured.

At the close of the month the season was fully two weeks backward. The cold weather and storms of the month resulted in the loss of some lambs, calves, and shorn sheep. The good range feed placed all stock in fine condition by the close of the month.—W. S. Palmer.

SPECIAL CONTRIBUTIONS.

MARCH AND WINTER WINDS.

By MR. WILLIAM B. STOCKMAN, Forecast Official.

After reading the interesting article by B. C. Webber, Esq., on "March winds" in Ontario, Quebec, and the Maritime Provinces of Canada, which appeared in the MONTHLY WEATHER REVIEW for March, 1903, it occurred to me that in the various parts of the United States where I have been stationed during the last twenty-five years, I had not experienced conditions similar to those that prevailed over Canada.

Believing it would be of general interest to know the average character of winds that prevailed over that portion of the

United States which would be under discussion, and to verify my own impressions, I selected 20 stations lying between the Atlantic Ocean and about the one hundredth meridian, west, and the northern border of the United States and the Gulf of Mexico, and compiled the subjoined data for the selected stations for the months of December, January, February, and March for a period of twenty years, so far as practicable.

In determining what should be considered a storm, a maximum velocity of 30 miles per hour was decided upon for inland stations, except for Dodge, Kans., which was raised to 35 miles on account of the high average wind movement obtaining at

Wind movement and storm frequency at selected stations in the United States.

Stations.	Average monthly wind movement.				Number of storms.			Number of days with snow.			Temperature departures, number of times on stormy days, above and below normal, respectively.			March.		
	December.	January.	February.	March.	December.	January.	February.	March.	December.	January.	February.	March.	December.	January.	February.	March.
Bismarck, N. Dak.	6,021	6,277	6,245	7,494	99	103	111	111	26	24	40	33	+73	+65	+64	+18
Boston, Mass.	9,218	9,326	9,022	10,012	97	108	121	115	17	32	37	37	-24	-37	-45	-15
Buffalo, N. Y.	11,871	11,493	10,116	10,316	123	113	89	72	59	72	70	38	+54	+57	+58	+53
Charleston, S. C.	6,004	6,718	6,607	7,090	18	26	43	39	.....	.....	.....	.....	-41	-44	-61	+55
Chicago, Ill.	10,674	11,350	10,716	12,145	57	51	59	86	15	10	30	24	+81	+63	+49	+41
Detroit, Mich.	8,679	8,518	7,868	8,504	33	35	40	49	10	14	20	13	-38	-45	-35	-25
Dodge, Kans.	7,445	7,418	7,224	9,540	61	54	54	105	6	11	5	7	+12	+14	+23	+21
Eastport, Me.	9,486	10,119	9,119	9,420	97	117	106	95	42	62	69	46	-3	-11	-17	-16
Galveston, Tex.	8,342	8,711	8,137	8,999	65	62	62	73	1	2	.....	.....	+30	+26	+26	+44
Indianapolis, Ind.	6,353	6,506	5,936	6,861	33	60	59	70	11	14	18	12	+27	-22	-31	-39
Marquette, Mich.	8,131	8,096	6,961	7,353	70	74	57	57	38	44	33	30	+10	+18	+15	+19
Montgomery, Ala.	4,464	4,843	4,921	5,326	28	35	60	54	3	.....	2	1	-51	-41	-45	-53
Nashville, Tenn.	5,132	5,462	5,218	6,028	48	72	83	123	5	5	10	10	+17	+33	+28	+46
New York, N. Y.	9,779	10,038	10,078	10,641	121	125	160	141	11	20	29	27	-16	-24	-30	-23
Norfolk, Va.	6,341	6,631	6,657	7,581	90	106	134	142	3	12	13	11	+41	+51	+36	+43
Omaha, Nebr.	6,142	6,296	6,023	7,250	34	49	44	51	13	19	18	18	+14	+15	+27	+25
Pittsburg, Pa.	5,202	5,604	5,235	5,432	32	53	57	44	16	24	28	14	+29	+44	+53	+82
St. Louis, Mo.	8,665	8,813	7,970	9,113	80	97	92	119	18	17	23	13	-17	-23	-26	-39
St. Paul, Minn.	5,284	5,288	5,192	6,079	39	48	43	76	16	18	17	24	+12	+22	+13	+21
Shreveport, La.	5,463	5,506	5,414	6,293	56	54	71	86	3	1	4	.....	-23	-16	-34	-31

that station. For stations along the littoral of the Great Lakes, Atlantic Ocean, and the Gulf of Mexico the verifying velocities now in force were used, except that at Chicago previously to February 1, 1890, a velocity of 30 miles was used; and at New York of 30 miles prior to October 16, 1898, the change in the verifying rate being due to increase in height of the exposure of the anemometers.

in March at all of the selected stations, except Eastport, Buffalo, Pittsburg, Detroit, and Marquette, that is to say, except in northern New England, the upper Ohio Valley, lower Lake region, and the eastern and northern portions of the upper Lake region. Storms were most frequent in December at Buffalo; in January at Marquette, and Eastport; in February at Pittsburg, Boston, New York, Charleston, and Montgomery;



FIG. 1.

From the tables it will be seen that the mean monthly wind movement during the months under discussion was greatest



FIG. 2.

and during March at the remaining stations; that is, storms, apparently, are more frequent in March than they are in the

winter months, except in the east Gulf States, along the Atlantic coast generally, in the lower Lake region, upper Ohio Valley, and northern portion of the upper Lake region. That storms are less frequent in March in portions of the Great Lakes is not entirely borne out by the figures given in Professor Garriott's Bulletin K, *Storms of the Great Lakes* (of which he kindly permitted me to see the proof sheets), as for the 25-year period 1876-1900, December shows 35 storms, January 16, February 14, and March 22. In this Bulletin, however, only very severe storms, dangerous to shipping, were considered.

March windstorms, apparently, are not the ones most frequently attended with snow, for only at Boston and St. Paul were they so. No snow occurred with the March storms at Charleston. The December storms were most frequently attended with snow at Montgomery; the January, at Buffalo, Dodge, Galveston, Marquette, Nashville, and Omaha; and during February at the remaining stations.

It will, perhaps, surprise many persons to learn that the windstorms of the winter months and March, are generally attended with temperatures above the normal, and in numerous instances the proportion of temperatures above normal on windy days over those of below normal temperatures, is quite marked. In January the greater proportion of strong winds were attended with temperatures below normal at Montgomery and New York; in February at Boston, Chicago, Indianapolis, Montgomery, New York, Pittsburg, and St. Paul; in March at Boston, Montgomery, and New York; and during all the four months at Omaha and Galveston, the proportion at the latter city being quite marked.

The idea that if March comes in like a lion it will go out like a lamb, or vice versa, is not borne out by the figures, for on both the first and last days of the same month the wind did not reach the verifying velocity from 70 to 95 per cent of the time at the various stations. The greatest number of times March came in stormy was six at Marquette; and went out under like conditions the same number of times at Norfolk.

The number of times the wind reached the verifying velocity at the various stations, at the time of the vernal equinox, March 21, ranged from one to six, or from 5 to 30 per cent of the time.

A WATERSPOUT OFF HATTERAS.

By Mr. THOMAS B. HARPER.

Mr. T. F. Townsend, Local Forecast Official, forwards several photographs of waterspouts, taken by Mr. Thomas B. Harper of Philadelphia, and observed off the Hatteras Lightship, on the afternoon of April 26, 1903. Although the photographs, owing to the absence of any means for determining the true dimensions of the spouts, do not add to our knowledge any definite numerical details, yet the general description given by Mr. Harper is worthy of reproduction and reads as follows:

In reply to your request I take pleasure in inclosing you photographs of the waterspouts which occurred off Hatteras Lightship, about 3:15 p. m., April 26, 1903, on the north edge of the Gulf Stream, as seen from steamship *Watson*.

There were 5 distinct spouts in all; we were about 6 miles, a little south of east, of the lightship at the time, steaming about north; the wind had shifted in the early morning from about northeast to strong southwest; the rainstorm formed about noon, we were running into a light rain about 3 p. m.; it was, however, raining hard north and east of us. The storm was a well-defined line north and south, with a clear sky to west, with strong wind coming out of northwest. After the storm struck us we followed the storm for sometime, the spouts being on our port for over half an hour. The last one that formed finally worked so close to us that we were compelled to turn quickly to starboard and run due south; the spout worked so close to us that the steamer cleared it less than one-quarter of a mile. It was then so dark overhead that the negatives did not show the spout, although we were so close we could hear the roar of the wind, and see the swirl and suction of the column of water from the surface. As the spout passed us the temperature fell from 75° to 55° in a few minutes, with strong northwest wind.

The photos show views of two other spouts, the first one being too far off to photograph. We had in full view, at one time, three distinct spouts within one to one and one-half miles.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18' N., 157° 50' W. It is the Hawaiian Weather Bureau station Punahoa. (See fig. 2, No. 1, in the *MONTHLY WEATHER REVIEW* for July, 1902, page 365.) Hawaiian standard time is 10° 30' slow of Greenwich time. Honolulu local mean time is 10° 31' slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, -0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, May, 1903.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.						Total rainfall at 9 a. m., local time.	
		Dry bulb.	Wet bulb.	Temperature.	Means.	Wind.		Average cloudiness.	Sea-level pressures.		
						Dew-point.	Relative humidity.				
		Maximum.	Minimum.								
1	*	69	67.5	82	67	66.7	82	se-ne.	2-0	4-10	30.06
2	30.01	73	67.5	81	67	66.0	77	s-ne.	2-2	8-2	30.06
3	30.04	68	65.5	82	70	63.7	67	ne.	3	4	30.09
4	30.03	68	64	82	67	62.3	70	w-ne.	1-3	8-1	30.08
5	30.04	72	65.3	80	66	60.3	65	nne.	3	4-1	30.08
6	30.02	72	65	80	67	60.3	64	ne.	4-5	4-1	30.10
7	30.04	71	64	80	71	61.3	66	ne.	4-5	3-7	30.09
8	30.05	70	64.5	79	67	60.0	63	ne.	4-5	4	30.11
9	30.05	71	65	78	68	61.7	68	ne.	4	4	30.11
10	30.07	67	63	80	69	62.0	67	ne.	3	3-5	30.12
11	30.04	70	65	80	66	60.5	67	ne.	3-1	3-8	30.12
12	30.01	72	65	78	69	61.3	70	ne.	2-0	8-3	30.06
13	30.04	72	67	81	68	60.5	62	ne.	3	4	30.09
14	30.03	72	67.5	80	70	64.3	72	ne.	3-5	5	30.10
15	29.99	73	67	81	71	63.5	67	ne.	4	3	30.06
16	30.01	67	65	81	69	64.7	72	se-ne.	1-0	7-3	30.06
17	30.02	68	66.5	81	66	67	80	sw-n.	1-0	6	30.08
18	29.99	72	70	82	68	65.5	72	s-ne.	1-0	5-2	30.05
19	29.98	72	67	81	67	67.0	76	s-ne.	1	6-2	30.05
20	29.95	70	68	78	71	67.0	80	s-ne.	1-0	3-9	30.03
21	29.99	74	67.5	83	68	67.0	78	se-ne.	2-0	8-4	30.02
22	30.04	74	69	82	72	65.0	70	ne.	3-0	5	30.09
23	30.06	73	65	81	71	64.0	68	ne.	4	5	30.14
24	30.06	72	67	80	72	65.0	62	ne.	5	3	30.12
25	30.05	73	66	80	70	63.3	67	ne.	5	5-3	30.12
26	30.04	73	66	79	72	63.0	68	ne.	5	4	30.09
27	30.09	73	66	80	69	63.3	71	ne.	5	5	30.14
28	30.07	72	67	77	70	64.3	74	ne.	5	8	30.13
29	30.04	72	65	79	69	63.3	69	ne.	4	7	30.08
30	30.05	73	64.5	80	70	61.5	64	ne.	3-4	4	30.09
31	30.10	72	67.5	79	70	61.5	65	ne.	4	4	30.15
Sums.											1.86
Means.	30.032	71.3	66.1	80.0	69.0	63.2	69.7		3.0		30.089 30.005
Departure.	+ .015					-0.7	-2.8				-0.82

Mean temperature for the month of May, 1903, $(6+2+9)+3=74.2^{\circ}$; normal is 74.2° . Mean pressure for the month of May, 1903, $(9+3)+2=30.044$; normal is 30.029.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of $(6+9+2+9)+4$. § Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

GENERAL SUMMARY FOR MAY, 1903.

Honolulu.—Temperature mean for the month, 74.2° ; normal, 74.2° ; average daily maximum, 80.0° ; average daily minimum, 69.0° ; mean daily range, 11.0° ; greatest daily range, 15° ; least daily range, 6° ; highest temperature, 83° ; lowest, 66° .

Barometer average, 30.044; normal, 30.029; highest, 30.15, lowest, 29.94; greatest 24-hour change, that is, from any given hour on one day to the same hour on the next, 0.06; lows passed this point 15th to 22d; highs, 10th, 23d, and 31st.

Relative humidity average, 69.7 per cent; normal, 72.5 per cent; mean dew-point, 63.2° ; normal, 63.9° ; mean absolute moisture, 6.39 grains per cubic foot; normal, 6.53 grains.

Rainfall, 1.86 inches; normal, 2.68 inches; rain record days, 25; normal, 19; greatest rainfall in one day, 0.36, on the 20th; total at Luakaha, 6.94; normal, 9.25; at Kapiolani Park, 0.27; normal, 1.17.

The artesian well water level fell during the month from 34.75 to 34.65 feet above mean sea level. May 31, 1902, it

stood at 33.85. The average daily mean sea level for the month was 9.65 feet, the assumed annual mean being 10.00 feet above datum. For May, 1902, it was 9.66.

Trade wind days, 26, (1 NNE.); normal, 24; average force of wind during daylight, Beaufort scale, 3.0. Average cloudiness, tenths of sky, 4.8; normal, 4.4.

Rainfall data for May, 1903.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.	
HAWAII.						
HILO, e. and ne.	Feet.	Inches.	MAUI—Cont'd.	Feet.	Inches.	
Walakea	50	6.74	Haleakala Ranch	2,000	1.13	
Hilo (town)	100	7.74	Wailuku, ne.	250	0.03	
Kaumana	1,230	11.01	OAHU.			
Pepeekeo	100	6.96	Punahoa (W. B.), sw.	47	1.86	
Hakalau	200	5.63	Kulaokahua (Castle), sw.	50	1.21	
Honohina	300	5.93	Makiki Reservoir	120	1.89	
Puuhonua	1,050	9.45	U. S. Naval Station, sw.	6	0.95	
Laupahoehoe	500	4.31	Kapiolani Park, sw.	10	0.27	
Ookala	400	2.24	College Hills	175	2.70	
HAMAKUA, ne.						
Kukaiau	250	1.40	Manoa (Woodlawn Dairy), e.	285	6.94	
Paauilo	300	0.95	Manoa (Rhodes Gardens)	360	7.77	
Paauhau	300	0.85	School street (Bishop), sw.	.....	.....
Honokaa (Mill)	425	1.28	Insane Asylum, sw.	30	1.31	
Honokaa (Meinicke)	1,100	.....	Kamehameha School	.....	.....
Kukuihale	700	0.84	Kalihii-Uka, sw.	485	5.12	
KOHALA, n.						
Awini Ranch	200	1.66	Nuuau (W. H. Hall), sw.	50	2.37	
Niuli	200	1.66	Nuuau (Wyllie street)	.....	.....
Kohala (Mission)	521	1.82	Nuuau (Elec. Station), sw.	405	2.58	
Kohala (Sugar Co.)	270	1.51	Nuuau (Luakaha), e.	850	6.94	
Hawi, Mill.	700	2.23	U. S. Experiment Station	350	3.64	
Puakea Ranch	600	1.93	Laniakena (Nahuina)	1,150	6.38	
Puuhue Ranch	1,847	.....	Tantalus Heights	1,360	7.12
Waimea	2,720	1.54	Waimanalo, ne.	25	0.99	
KONA, w.						
Holualoa	1,350	4.29	Maunaehi, ne.	300	5.10	
Kealakekua	1,580	4.61	Kaneohe	100	2.32	
Napoopo	25	4.48	Ahuimanu, ne.	350	2.90	
Hoopulon	1,650	2.19	Kahuku, n.	25	0.99	
Hoopulon	2,500	3.87	Waihala	37	0.87	
KAU, se.						
Kahuku Ranch	1,680	1.16	Waihala	900	3.41	
Honuapo	15	0.75	Ewa Plantation, s.	60	0.89	
Naalehu	650	2.09	U. S. Magnetic Station	45	0.51	
Hilea	310	0.07	Waipahu	200	0.00	
Pahala	850	0.73	Moanalua	15	1.30	
Mousa	1,700	.....	Pacific Heights	700	4.25
Volcano House	4,000	KAUAL.			
PUNA, e.						
Olaa, Mountain View (Russel)	1,690	11.70	Lihue (Grove Farm), e.	200	1.58	
Olaa (Plantation)	.....	.....	Lihue (Molokoa), e.	300	1.78
Kapoho	110	1.80	Lihue (Kukaua), e.	1,000	3.94	
Pahoa	600	8.25	Kealia, e.	15	0.92	
MAUL.						
Lahaina	40	.....	Kilauea, ne.	325	0.70
Waipae Ranch	700	.....	Hanalei, n.	10	1.80
Kaupo (Mokulau), n.	285	5.09	Waipoli	15	.....
Kipahulu, s.	308	.....	Haena	15	1.50
Hana	.....	.....	Elele	.....	.....
Nahiku, ne	850	7.41	Wahia (Mountain)	.....	.....
Nahiku	1,600	.....	McBryde (Residence)	850	2.70
Haiku, n.	700	2.62	Lawai (Gov. Road)	450	3.51	
Kula (Erehwon), n.	4,000	2.01	Lawai, w.	225	1.21	
Kula (Waiakoa), n.	.....	.....	Lawai, e.	800	3.38
Puonomelei, n.	1,400	2.11	Koloa	100	2.35	
Paia	Delayed April reports.			
<i>Hawi Mill.</i>						
<i>Waiwai Ranch.</i>						
<i>Kahuku Ranch.</i>						

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Approximate percentages of district rainfall as compared with normal: Hilo, 63 per cent; Hamakua, 26; Kohala, 43; Waimea, 57; Kona, 77; Kau, 62; Puna, 83; Maui, 66; Oahu, 57; Kauai, 38. The heaviest 24-hour rainfalls for the month were at Kaumana, 1.94; Puuohua, 1.90, on the 22d; and at Rhodes Gardens, Manoa, 1.80, 20th. Heaviest monthly rainfall, Mountain View, Olaoa, 11.70 inches.

Kohala dew-point average, 63.9°; humidity, 76.1 per cent; Magnetic Station, 63.6° and 67.0 per cent.

The unusually large meteor mentioned in April report as having been seen at Hilo on the 30th of that month is reported from Pepeekeo as having burst high in air over the latter place.

Hawaiian rainfall for the year 1902.

Stations.	Elevation.	Rain.	Normal.	Stations.	Elevation.	Rain.	Normal.
HAWAII.							
HILO.	Feet.	Inches.		MAUI—Cont'd.	Feet.	Inches.	
Waiakea	50	6.74		Haleakala Ranch	2,000	1.13	
Hilo (town)	100	7.74		Wailuku, ne.	250	0.03	
Kaumana	1,230	11.01		OAHU.			
Pepeekeo	100	6.96		Punahoa (W. B.), sw.	47	1.86	
Hakalau	200	5.63		Kulaokahua (Castle), sw.	50	1.21	
Honohina	300	5.93		Makiki Reservoir	120	1.89	
Puuhonua	1,050	9.45		U. S. Naval Station, sw.	6	0.95	
Laupahoehoe	500	4.31		Kapiolani Park, sw.	10	0.27	
Ookala	400	2.24		College Hills	175	2.70	
HAMAKUA, ne.							
Kukaiau	250	1.40		Manoa (Woodlawn Dairy), e.	285	6.94	
Paauilo	300	0.95		Manoa (Rhodes Gardens)	360	7.77	
Paauhau	300	0.85		School street (Bishop), sw.	.....	.....
Honokaa (Mill)	425	1.28		Insane Asylum, sw.	30	1.31	
Honokaa (Meinicke)	1,100	.....		Kamehameha School	.....	.....
Kukuihale	700	0.84		Kalihii-Uka, sw.	485	5.12	
KOHALA, n.							
Awini Ranch	200	1.66		Nuuau (W. H. Hall), sw.	50	2.37	
Niuli	200	1.66		Nuuau (Wyllie street)	.....	.....
Kohala (Mission)	521	1.82		Nuuau (Luakaha), e.	850	6.94	
Kohala (Sugar Co.)	270	1.51		U. S. Experiment Station	350	3.64	
Hawi, Mill.	700	2.23		Laniakena (Nahuina)	1,150	6.38	
Puakea Ranch	600	1.93		Tantalus Heights	1,360	7.12	
Puuhue Ranch	1,847	.....		Waimanalo, ne.	25	0.99	
Waimea	2,720	1.54		Waihala	37	0.87	
KONA, w.							
Holualoa	1,350	4.29		Waihala	900	3.41	
Kealakekua	1,580	4.61		U. S. Magnetic Station	45	0.51	
Napoopo	25	4.48		Waipahu	200	23.72	
Hoopulon	1,650	2.19		Moanalua	15	44.77	
Hoopulon	2,500	3.87		KAUAL.			
KAU.							
Kahuku Ranch	1,680	1.16		Kahuku Ranch	1,680	32.32	
Honuapo	15	0.75		Honuapo	15	26.59	
Naalehu	650	2.09		Naalehu	650	32.25	
Hilea	310	0.07		Hilea	310	29.80	
Pahala	850	0.73		Pahala	850	39.49	
Mousa	1,700	.....		Mousa	1,700	48.50	
Volcano House	4,000	.....		Volcano House	4,000	89.39	
PUNA.							
Olaa, Mountain View	1,690	11.70		Lihue (Grove Farm)	200	68.00	
Olaa (Plantation)	.....	.....		Lihue (Molokoa)	300	71.48	
Kapoho	110	1.80		Lihue (Kukaua)	1,000	126.38	
MAUL.				Kealia	15	62.49	
Waipae Ranch	700	.....		Kilauea Plantation	325	104.38	
Kaupo (Mokulau), n.	285	5.09		Hanalei	10	161.45	
Kipahulu, s.	308	.....		Waipahu	32	15.05	
Hana	.....	.....		Waipahu	32	24.18	
Nahiku, ne	850	7.41		Elele	150	30.59	
Nahiku	1,600	.....		Nahiku	900	275.35	
Haiku, n.	700	2.62		Nahiku	1,600	418.00*	
Kula (Erehwon), n.	4,000	2.01		Haiku	700	97.79	
Kula (Waiakoa), n.	.....	.....		Kula (Erehwon)	4,500	70.96	
Puonomelei, n.	1,400	2.11		Kula Ranch	33.41	.....
Paia	.....	.....			

* January and February interpolated from Nahiku 900.

NOTE.—Maui stations are many of them comparatively new, consequently no normals.

Summary for the year 1902, Honolulu, H. I.

Months.	Pressure at sea level.			Temperature.				Humidity.			Rain.	Clouds.	Wind.*			
	9 a. m.	3 p. m.	Mean.	8 a. m., Washington time.	Mean,†	Mean maximum.	Mean minimum.	Highest.	Lowest.	Grains per cubic foot.	Dew point,‡	Relative humidity,‡	NE.	SE.	SW.	N

leaving a trail like a narrow cloud for some length of time. Thunder at Pepeekeo, May 1. Snow on Mauna Loa 21st. Heavy surf 15-19, 23-28.

The rainfall of 1902 was extraordinary in amount in all districts, Naalehu and Hilea in Kau and Waiawa in Kauai being the only exceptional stations, while at some points the rainfall was more than twice the normal.

Figures in black type indicate that one or two months are missing from the year's record, but are interpolated from adjacent stations. Where three or more months are lacking the station is omitted from this list.

Mean temperature table for May, 1903.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.
Pepeekeo	o	o	o	o
Hilo	100	76.8	68.3	71.9
	40	84.3	66.5	74.7
Kohala	521	77.5	65.6	70.9
Waimea	2,730	70.4	58.3	63.7
Waiakoa	2,700	83.6	55.9	69.0
United States Magnetic Station	50	83.8	67.1	74.8
United States Experimental Station	350	80.6	68.5	74.2
Waikiki	15	80.8	70.5	75.0

HIGH WINDS AT POINT REYES LIGHT, CAL.

By Mr. W. W. THOMAS and Prof. A. G. McADIE.

Mr. W. W. Thomas, Observer, Point Reyes Light, Cal., through Prof. Alexander G. McAdie, communicates tables and charts comparing together the wind velocities during two memorable gales at the former station in May, 1902, and 1903. He adds: "It is believed that the record of an average hourly movement of the air, exceeding 50 miles per hour, for a period of nine consecutive days (May 13-23, 1903) is unparalleled in the records of the Weather Bureau." Professor McAdie says: "I have added a few notes giving the air movement at Point Lobos, Cal., San Francisco, Mount Tamalpais, and Southeast Farallon, as the grouping of the stations makes it possible to discuss the air movement at sea level, on the ocean, a little above sea level on headlands, and at a height of half a mile on Tamalpais."

Two memorable northwest gales at Point Reyes Light, Cal.

Date.	Average velocity, miles per hour.				Daily movement.	Maximum velocity.	Extreme velocity.	Time of maximum velocity.
	0 to 6 a.m.	6 a.m. to 12 noon.	12 noon to 6 p.m.	6 p.m. to 12 midnight.				
1902.					Miles.	Miles.	Miles.	Miles.
May 13.	4	11	10	188	188	8	16	16
14.	11	14	12	347	347	14	28	30
15.	29	31	31	756	756	31.5	45	50
16.	39	38	46	1,086	1,086	45	76	80
17.	64	54	67	1,580	1,580	66	90	96
18.	75	70	79	1,876	1,876	78	110	120
19.	59	45	59	1,360	1,360	57	75	80
20.	46	27	31	905	905	38	57	62
21.	34	12	11	474	474	20	48	50
22.	21	7	9	291	291	12	27	29
23.	17	7	10	287	287	12	26	30
1903.								
May 13.	9	11	35	410	410	17	48	50
14.	51	39	47	1,153	1,153	48	64	66
15.	43	44	63	1,371	1,371	57	89	93
16.	72	60	65	1,673	1,673	70	94	98
17.	62	42	51	1,339	1,339	56	80	92
18.	58	52	48	1,247	1,247	52	68	70
19.	45	45	47	1,124	1,124	47	60	62
20.	42	42	50	1,103	1,103	46	58	60
21.	47	47	53	1,227	1,227	51	64	66
22.	42	39	39	986	986	41	59	61
23.	47	19	18	679	679	28	52	54

As the diagram accompanying Mr. Thomas's communication is but little more instructive than the tabular data, we refrain from publishing it; the proper fractions given by Mr. Thomas have been omitted as the nearest whole figure is sufficient; the maximum hourly velocities are the averages for five minutes;

the extreme hourly velocities are deduced from the records for single miles. The table referred to by Professor McAdie will be found on page 220.—C. A.

LANTERN SLIDES.

Dr. O. L. Fassig communicates the following list of lantern slides that he has had made for his lectures on meteorology at Baltimore, Md. Duplicates of the slides marked "n" (negatives) can be furnished those who desire them at the rate of 25 cents each; a negative and slide will cost 50 cents. If any item includes many slides the corresponding number is given.

1. Whirling alto-stratus.
- 1 n. Umbrella cloud. *MONTHLY WEATHER REVIEW.* 1902.
- 1 n. Diurnal barometric wave, North America and South America.
- 1 n. Diurnal barometric wave, path of center.
1. Solar halo, Columbus, Ohio.
- 1 n. Cluster of snow crystals.
2. The "Umbria" after a snowstorm.
- 2 n. Effect of heavy snow on trees.
- 1 n. Effect of hailstorm on corn field.
1. Distant view of tornado.
- 1 n. Fake tornado.
- 2 n. New Richmond tornado.
- 1 n. Louisville tornado, March 27, 1890.
- 3 n. West Indian hurricane, 8 a. m., August 7, 8, and 13, 1899.
- 1 n. Galveston hurricane, September 8, 1900. (Isobars.)
- 1 n. Typical storm area, February 28, 1902, 8 a. m.
- 3 n. Typical Gulf storm, February 20, 21, and 22, 1902.
- 3 n. Typical Lake storm, December 24, 25, and 26, 1902.
- 1 n. Storm tracks and storm frequency.
- 2 n. Storm tracks, January and February, 1903, United States.
- 1 n. Daily weather map, United States. Typical low area in Mississippi Valley.
- 1 n. Paths of highs and lows across the United States with rate of progress.
- 1 n. Flat map, June 15, 1896, 8 a. m.
- 1 n. Normal temperatures in United States, January.
- 1 n. Normal temperatures in United States, July.
- 3 n. Baltimore daily weather, 1871-1902; February 22, March 4, and July 4.
- 1 n. Baltimore normal daily temperature; average maximum, minimum, and barometer.
- 1 n. Baltimore temperatures; daily ranges and extremes.
- 1 n. Baltimore monthly temperature departures, 1817-1902.
- 1 n. Diurnal variation of temperature at Baltimore on clear, cloudy, and rainy days.
- 1 n. Relation between temperature and wind direction January, April, July, and October, at Baltimore.
- 1 n. Diurnal and annual changes of wind velocity at Baltimore.
- 1 n. Diurnal variation of temperatures at Baltimore as affected by wind velocity.
- 1 n. Baltimore rainfall probability; 5-day means, daily and average amounts.
- 1 n. Normal daily temperatures at Baltimore, April 20-June 28.
- 1 n. Sun-spot frequency and temperatures at Baltimore.
- 1 n. Unusual succession of rainy Sundays, Baltimore, September, 1902, to February, 1903.
6. Fog billows, San Francisco, Cal.
- 1 n. The moon and the weather.
- 1 n. The coronal period and meteorological and magnetic phenomena.
- 1 n. Sun-spot frequency and temperature, rainfall, hail, and vintages.
- 1 n. Sun-spot frequency and magnetic declination.
1. Marvin's kite meteorograph.
22. Typical cloud forms.
- 1 n. Typical cumulus. Hann.
- 1 n. Thunderhead, Java.
- 1 n. Typical cloud forms arranged in order of occurrence. (Inward.)
- 4 n. Hail clouds.
- 1 n. Ideal cross section of hail cloud.
- 4 n. Hail stones.
- 1 n. Hail shooting in Italy.
- 1 n. An aurora, Germany, eighteenth century.
- 1 n. Solar halo and mock suns.
- 1 n. Solar halo, seventeenth century.
25. Snow crystals.
1. Snow under the equator.
1. Lightning flashes.
1. Tree struck by lightning.
- 1 n. Approaching tornado. *Frank Leslie's Weekly.*
- 1 n. Tornado, Germany, sixteenth century.
- 1 n. Waterspouts, Florida coast.
- 1 n. Sun-spot frequency and June temperature at Bremen.
- 1 n. Rynmann's *Wetterbuchlein.* Edition of 1510, Augsburg.

1 n. Rynmann's *Wetterbuchlein*. Table of contents, edition of 1510, Munich.
 1 n. *Bauern Praktik*. Munich, 1512.
 1 n. *Die Bauern Praktik*. Edition of 1508, first page.
 1 n. *Practica auf das Jahr 1502*.
 1 Famine areas in India.
 3 n. Baltimore weather, 1871-1902; May 1, September 12 and December 25.
 1 n. Baltimore rainfall. Daily frequency, 1871-1900.
 1 Diurnal temperature curve for Baltimore for the year.
 1 Kite flight at Blue Hill Observatory.
 1 n. Cyclone prognostics. Abercromby.
 1 n. Typical storm at sea, North Atlantic Ocean.
 4 n. Storm tracks for February, April, July, and October, in the United States, ten years.
 4 n. Cold wave, February 11, 12, 13, and 14, 1899.
 1 n. Typical high area, fair weather, September 14, 1902.
 1 n. Type of fair weather, February 20, 1903.

METEOROLOGICAL OBSERVATIONS OBTAINED BY THE USE OF KITES OFF THE WEST COAST OF SCOTLAND, 1902.

By W. N. SHAW, Sc. D., F. R. S., and W. H. DINES, B. A. Read before the Royal Society, London, May 14, 1903.

ABSTRACT FURNISHED FOR THE MONTHLY WEATHER REVIEW.

This paper presents the results of the first organized attempt to obtain a series of automatic records of temperature and humidity in the upper air of the British Isles or neighboring seas by means of kites. They are derived from the records of forty kite ascents in which instruments were raised, and which were carried out by Mr. Dines and his two sons, under the auspices of the Royal Meteorological Society in cooperation with a committee of the British Association, during the months of July and August, 1902. Two of the ascents were from a small island in Crinan Bay, Argyllshire, the remainder from the deck of a tug steaming in the Jura Sound or neighboring sea. Kites were raised on seventy-one occasions, but, on thirty-one of them, the force of the wind, even when assisted by the speed of the tug at seven knots, was not sufficient to raise the recording instruments. On those occasions an experimental form of registering air thermometer alone was carried. The average recorded height of ascents with instruments was 5900 feet (1940 meters), and average estimated height of the seventy-one ascents 4200 feet (1400 meters); a height of 12,000 feet (3700 meters) was passed on two occasions and 15,000 feet (4500 meters) was reached once, but the record was lost owing to the breaking away of the highest kite.

The kites and winding gear were designed and constructed by Mr. Dines. Particulars as to them are given in the Quarterly Journal of the Royal Meteorological Society, vol. 29, p. 69, 1903.

The greatest angular elevation given by the kites with a short length of line was $62^{\circ} 31'$; the greatest height reached with one kite was 5500 feet (1700 meters), with two 9200 feet (2800 meters), with three 12,400 feet (3800 meters).

The method of dealing with the records is described and illustrated. The results are expressed on a diagram representing, by a series of points and connecting lines, the height in the air of a series of temperatures at successive intervals of 1° C. for each ascent. The diagram thus presents a series of isothermal lines referred to time and height as coordinates. So far as the observations extend, the changes in the actual and relative positions of the lines show how the temperature varied at the surface and in the upper air during the period of the experiments.

On account of the unsatisfactory nature of the hygrometric records only four stages of humidity are dealt with, and these are entered upon the diagram upon which are also recorded the observed heights of clouds entered by the kites, the direction of the wind at the surface and in the upper air, and particulars of the weather.

For the purpose of comparison the curves of variation of the barometer at Fort William and Ben Nevis, during the period of the experiments, are plotted on the same diagram, and cer-

tain particulars are also given about the temperatures of the wet and dry bulb at those stations.

From the diagram the fall of temperature for each 500 meters of each ascent is taken out and tabulated. The table gives the following average results:

Table of fall of temperature, in degrees centigrade, for each 500 meters of ascent.

Meters.	July.		August.	
	Ascents.	° C.	Ascents.	° C.
0 to 500	22	3.0	13	2.6
500 to 1,000	16	2.8	11	2.8
1,000 to 1,500	9	2.2	9	2.3
1,500 to 2,000	2	2.0	7	2.1
2,000 to 2,500	1	2.0	3	2.0
2,500 to 3,000	-----	-----	2	2.0
3,000 to 3,500	-----	-----	2	1.7

The range of fall for the first 500 meters varied from 4° C. to 1° C. The smallest fall was associated with an inversion of temperature gradient not far from the surface. An inversion of temperature gradient with very dry air above a layer of clouds was shown also on one of the occasions of steepest gradient near the surface. The steep gradients observed in the lower strata are shown to be associated with anticyclonic conditions preceding the approach of a depression, and by examples on five occasions it is shown that the characteristic of the passage of a depression is that the isothermal lines of the diagram open out as the depression comes on, the average diminution of gradient for the change of barometric conditions amounting to as much as 50 per cent.

The paths of the centers of depressions producing these changes are shown on the maps taken from the monthly weather reports of the meteorological office. It appears that they passed the station on all sides at various distances, but none actually crossed it. The results show that whatever was the path taken by the center the column of air over Crinan became relatively much more nearly uniform in temperature under the influence of the depression, and therefore probably represented a relatively warm column of air.

The average of the values of temperature gradients in columns of air of different heights derived from all the Crinan ascents are as follows:

Height of column. Meters.	Temperature gradient. Per 100 meters.
500	0.56
1000	0.56
1500	0.52
2000	0.50
2500	0.48
3000	0.46
3500	0.43

It must be remembered that a moderately strong wind was required for the higher ascents, and they therefore refer to a more or less special type of weather. The gradients for the higher columns are accordingly not so generally applicable as those for the lower columns.

The results are compared with temperature gradients observed elsewhere as given in Hann's Meteorologie, with the theoretical temperature gradient in dry air (1° C. per 100 meters), and with that for saturated air having an initial temperature of 12° C. The last differs but little from 0.53° C. per 100 meters for all ranges up to 2000 meters and then increases. The average Crinan gradient is almost identical with this and with the conventional correction in use in this country [England] for the reduction of temperatures to a common level, viz, 1° F. per 300 feet.

The last part of the paper is devoted to considering the differences between the temperatures as observed in the free air at the same height as the summit of Ben Nevis and those read on the mountain itself. The differences are always in favor of the free air which is shown to be on the average 2.6°

warmer than the mountain summit. Various circumstances are adduced to support the result, and the explanation is sought in the suggestion that the air flowing from the sea over the mountain would be mechanically raised and practically subject to the adiabatic gradient which is not reached in the free air. The consideration of the relative heights of clouds as observed on the hillsides and over the sea is adduced in corroboration.

A CURIOUS COINCIDENCE. IS IT ACCIDENTAL OR GOVERNED BY LAW?

By Mr. G. N. SALISBURY, Section Director, Seattle, Wash.

Two or three years ago the writer noticed in the annual precipitation totals of the Seattle station a certain apparent recurrence or periodicity in groups or series of three, and looked forward with much interest to see whether it would longer continue. It was found that the light rainfall of 1901 filled the conditions of the recurrence, and the writer concluded that, in accordance with the series, the year 1902, as a whole, should be one of maximum precipitation. Therefore, even during the long dry spell of last summer and autumn, he never lost confidence that the deficiency in precipitation would be made up. That the confidence was justified was seen in the heavy rainfall of November and December, while the total precipitation for 1902 was 45.78 inches, the greatest amount since the beginning of the rainfall record at Seattle.

To illustrate more clearly what is meant, the total annual rainfalls at Seattle are given in their order, beginning with 1892: 31.32, 45.16, 41.08, 29.69, 42.83, 41.53, 29.28, 37.13, 36.43, 30.18, 45.78. A striking peculiarity may at once be recognized in the above figures, viz: beginning with 1892, every third year appears to be one of minimum rainfall, thus: 1892, 31.32; 1895, 29.69; 1898, 29.28; 1901, 30.18. Also every third year beginning with 1893 appears to be a maximum, thus: 1893, 45.16; 1896, 42.83; 1899, 37.13; 1902, 45.78. Representing the minimum values by *c*, the maximum values by *a*, and the intermediate values by *b*, there results a recurring cycle or series like this: *c..a..b..c..a..b..c..a..b..c..a..*. The records for 1890 and 1891 are incomplete, but judging from the record of Madrone, which is a near-by station, the year 1890 would be an *a* year and the year 1891 a *b* year, thus further extending the series.

Curiosity was naturally aroused to see if the same apparent 3-year cycle could be detected at other stations, and investigation revealed that at all stations throughout the State, so far as observations were complete, the same 3-year recurrence had obtained since 1890. As far as the investigation was pursued the same was found true in Oregon, Idaho, and extreme northern California.

This is certainly an interesting coincidence, if nothing more, and the question arises: "Is it an accidental one merely or is it one due to imperfectly understood cosmical causes, which may vary the track of precipitation-producing storms from year to year throughout a certain well-defined fluctuation, so that they return every third year to nearly the same position?"

Unless the records should show a similar recurrence extending back indefinitely we must conclude either (1) that the recurrence is wholly accidental or (2) that a new era has begun in the distribution of precipitation within recent years. In view of our well-established confidence in the constancy and permanence of natural phenomena, the latter conclusion is improbable. The former would be legitimate if there was sufficient past evidence, in the shape of records that could be relied upon. But unfortunately it is only within the past ten years that a considerable number of regular and reliable records of rainfall have been kept in this State. At only a few stations, viz: Spokane, Walla Walla, Vancouver, etc., does the record extend back as far as 1880. For the past twenty-five years at

Madrone the third year has always been one of minimum precipitation; but previous to 1890, the order of recurrence of the three years is reversed every cycle, so that we have such a series as: *a..b..c..b..a..c..a..b..c..b..a..c..a..b..c..*, etc.

That the annual rainfall should be arranged in a 3-year period in the order *a..b..c..*, for twelve years over the whole State is a remarkable coincidence, even if accidental, but that the recurrence should continue for twenty-five years, or over eight complete 3-year cycles, even at a single station, suggests that there may be a pronounced physical cause. The writer does not insist that it is anything more than a single coincidence, being aware that meteorologists have long ago decided that such a thing as a regular cycle in precipitation need hardly be looked for. The coincidence, however, is so suggestive as to make one ardently wish that the rainfall records of Washington and other Northwestern States, prior to 1890, were not so few, irregular, or unreliable. It is also an incentive to the public spirited voluntary observer to continue his valuable records, showing, as it does, how important his records are as data in the solution of vital climatic problems.

A further interesting coincidence is the correlation of the annual mean barometer with the apparent rainfall cycles. During the past twelve years at the Weather Bureau stations of Washington, Oregon, and Idaho, viz: Seattle, Spokane, Walla Walla, Boise, Pocatello, Baker City, Portland, and Roseburg, the third year of minimum rainfall has invariably coincided with a year of maximum annual mean barometer. The years of maximum rainfall have also coincided with years of minimum mean barometric pressure. A coincidence of maximum rainfall with low barometer and of minimum rainfall with high barometer, is in accordance with meteorological principles and might be naturally expected. But that it should continue throughout the calendar year, and also be in cycles of three, strengthens the suspicion that there may be something more than accident in the coincidence.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the drought continued up to the 8th, when the rain was general all over the country. The amount of rain for this month and also the duration of same have been without exception in excess over previous years. In San José temperature, pressure, and relative humidity have been about normal; rainfall, 371 millimeters against 230 millimeters, mean for 1889-1900; sunshine, 193 hours against 165 hours, with rather cloudy afternoons. On the Atlantic slope the rainfall was generally less than the normal.

Notes on earthquakes.—May 3, 3^h 36^m a. m., light shock E-W, intensity III, duration 10 seconds. May 14, 6^h 16^m a. m., very slight shock NW-SE, intensity II, duration 4 seconds. May 27, Tres Ríos reports one strong shock followed by another, rather protracted, not felt in Jan José. May 28, 2^h 03^m a. m., rather strong shock E-W, intensity IV, duration 6 seconds, reported also from San Isidro Alajuela. May 29, 11^h 47^m p. m., light shock NW-SE, intensity II, duration 3 seconds.

ATMOSPHERIC ELECTRICITY CONSIDERED FROM THE STANDPOINT OF THE THEORY OF ELECTRONS.¹

By Prof. HERMANN EBERT of the University at Munich.

Recent investigations into the composition of the air, which we already thought we knew so well, have revealed to us a number of new constituents among which the monatomic noble gases discovered by W. Ramsay, and more especially the so-called atmospheric ions or electrons of Elster and Geitel, appeal

¹ A lecture delivered before the eighty-fifth session of the Swiss Society of Natural Sciences, Geneva, 1902, and translated from the Meteorologische Zeitschrift, Bd. 20, 1903, pp. 107-114, by Dr. C. Abbe, Jr.

to the interest of a larger circle of students. The other constituents are in themselves electrically indifferent, as far as at present known, but the last named are distinguished by the fact that they are electrically charged; consequently these react very decidedly upon the forces that proceed from an electric body, whereas the electrically neutral bodies do not do so. The charges on these little particles are apparently neither chosen at will nor accidental, but are of a definite strength for each. From Faraday's law of electrolysis, according to which a definite amount of electricity always seems to be united to a chemically equivalent mass of matter, Helmholtz had already concluded that electricity must be conceived of as consisting of the smallest indivisible electrical quantities or elemental quantities. If one of these elemental quantities occupies the valence position of a material atom or of a combination of atoms, it forms what is called an electric ion. The characteristic of this ion is that by its presence a perfectly definite quantity of ponderable material is attached to a very small but also very definite quantity of electricity (of the order of magnitude 10^{-10} electrostatic units). More recent investigations into discharges through gases and the radiations which accompany them, particularly the studies on the cathode rays, have shown that the electrical elemental quantities also play an important rôle in these processes. The negatively charged particles, of which, for example, the cathode rays consist, have masses that are about 1000 times smaller than the smallest mass of which we have possessed any knowledge up to this time, viz: the hydrogen atom, or according to the investigations of J. J. Thomson, Lorenz, Kaufmann, and Abraham they have only an apparent mass. Since, however, an electric particle moving with great rapidity offers resistance to any change in the direction and velocity of its movements, it must perfectly exhibit the phenomena of inertia. If the characteristic factor belonging to it as a mass be multiplied by the acceleration produced, this product will represent the force required for the change of motion. This factor therefore plays the same rôle as the mass, even if we consider the electric particle itself as being without mass in the usual sense. These electric particles are called electrons to distinguish them from the ions, which latter are formed only after the electrons unite with atoms or combinations of atoms.

It has been possible to establish the presence of these electrons not only inside of the discharging tubes, but also in gases traversed by Röntgen rays, or Becquerel rays, and, according to Lenard, also in such gases as have absorbed the very short waves of ultraviolet light. That they also occur in the ordinary atmosphere of the earth has been demonstrated by Elster and Geitel, by exposing to the air a well insulated electrically charged metallic body, a so-called "dissipator." The loss of charge that occurs from this body can be very considerably increased if a wire cage charged to the same tension with the same kind of electricity be placed about the metallic dissipator and the electroscope.

This increased loss can not be explained by the action of dust, smoke, or moisture, but is only intelligible on the assumption that electrons of the opposite sign are attracted by the wire cage and are used up by the activity of the inclosed dissipator. Since the active surface of the cage is much greater than that of the object within it, therefore the latter will be discharged much more quickly than if the discharge took place without any cage; a conclusion fully borne out by the observed facts. Moreover, negatively laden wires hung in the open air acquire the induced radio activities so characteristic of the gases that have been excited by Becquerel rays, i. e., they become good electrical conductors and are provided with electrons.

In order to measure the charge of electrons contained in the air at a given time and place, the lecturer [Professor Ebert] had constructed an apparatus, which he exhibited. In this

apparatus a clockwork aspirator draws a definite quantity of air through the space between two coaxial metal cylinders fitting one into the other; the inner cylinder rests directly upon the electroscope, while the outer one serves as a protecting cylinder. If the capacity of the system and the quantity of air drawn through it in a given time is known, then one can (from the number of volts indicating the loss in tension during this time, after applying a small correction) calculate in absolute measure, the quantity of electricity that has been contained in a cubic meter of air as a charge of electrons. The apparatus is to a high degree free from the influence of the wind and of external electrical forces.

The very first determinations showed that the charges of electrons found at the surface of the earth were conditioned by the changes going on in the higher strata of the atmosphere and the circulatory motions occurring in them. Thus during the foehn the charge of electrons was not only absolutely very high, but there also occurred a noteworthy shifting of the normal distribution, showing that many more positive than negative electrons are contained in the air of the foehn. In order to explain these conditions the lecturer had worked up the data obtained by observers in free balloons with the Elster-Geitel atmospheric electrical apparatus, and with his own aspiration apparatus as used with the sounding balloon. Four such series were conducted by Dr. R. Emden who attained heights of over 7200 meters. H. B. De Saussure had already shown the necessity of undertaking electrical measurements in balloons if we are to learn anything about the character of the electrical phenomena of the atmosphere, and it would be most welcome if other countries would join in the simultaneous, international monthly balloon ascensions made from widely separated points in Europe. In fact these ascensions have already explained many points, but as so often happens in the investigation of infinite nature, so here, where one problem is solved a hundred new questions and problems arise. There is always work enough to be done.

The electronic charge, or the number of electrons, generally increases very rapidly with the altitude, so that we may conclude a proportionally very high degree of electrical conductivity for the highest strata; indeed we must assume this if we are to explain such phenomena as the aurora. Perhaps it is the passage of the ultraviolet rays from the sun through these regions that gives rise to the electrons.

In the lower layers of the atmosphere we generally find a preponderance of the positive charges and this is apparently due to the fact that the terrestrial globe is itself negatively charged and therefore attracts the positive electrons, but repels the negative ones. For this reason above mountain summits, where the density of the terrestrial charge attains a particularly high value, there is a preponderating number of positive electrons present; therefore when the foehn blows across the mountain crests it brings with it down into the valleys this upper air, rich in ions and with its excess of positive electrons.

This shifting of the electron content in one direction or the other appears to produce a specific effect upon the human organism. P. Czermak, who has studied this phenomenon in the foehn region at Innsbruck, is disposed to connect this fact with the so-called foehn sickness which attacks sensitive persons and for which up to this time no explanation has been found. In this connection the results of the Monte Rosa expedition for the investigation of the mountain sickness, recently reported on by Caspari, is very interesting. In hollows, caves, and chasms which communicate with the open air, but at the same time harbor a considerable quantity of quiet, stagnating air, the electron content may attain a very high figure; here also, as will be explained later, an outflow of the negative electrons and a constantly increasing rise in the quantity of positive electrons may take place. It is such partially

inclosed spaces, passages, etc., that according to the experiences of many mountain guides, are especially apt to give occasion for the complex phenomena of mountain sickness even where altitude or any other peculiarity of the air offers a predisposing cause for this effect. In such a passage on Monte Rosa, notorious for its mountain sickness, Caspary in fact found that the Elster-Geitel dissipator showed an enormously increased charge of electrons.

The theorem that in the higher, purer strata of the atmosphere the charge of electrons is larger than in the lower, is not without exceptions and apparently can not even be considered as of general scope. If in midsummer a high plateau or the southern slope of a mountain range is continuously and strongly illuminated by the sun, rising currents of air form and elevate the air which has for a long time been in contact with the surface of the earth; a system of ascending and descending circulations is established until the distribution of temperature with altitude corresponds to the adiabatic equilibrium. Each time when air comes into contact with the conducting surface of the earth the latter gives off a portion of its electrons to the air and thus the whole stratum of air gradually becomes saturated with them. This we were able to determine very clearly during two summer excursions in June and July, that we made from Munich in the early morning after the sun had, during the previous day, burned scorchingly on our upper Bavarian plateau. During the night the stratum lying immediately next the ground had greatly cooled off so that we did not at first find decreasing temperatures immediately above us, as is generally the case in balloon ascensions, but encountered rising temperatures, i. e., a so-called inversion of temperature. On the other hand, when we entered the stratum of air that had been warmed by the ground on the previous day, and had risen to a higher level, the temperature fell at the rate of about 1° C. per 100 meters of altitude, a rate characteristic of the adiabatic equilibrium. In this stratum we found almost exactly the same electrical conditions of the air as had been recorded with accurately compared instruments on the surface of the earth at various stations on the preceding day. In summer this stratum may attain a height of 2000 meters and even more over the Bavarian table-land.

At and above this elevation, however, the distribution of electrons is not by any means simple enough to permit one, by extrapolating from the values already found, to determine the electrical conductivity prevailing in those regions in which the polar auroral phenomena principally occur and which, according to both older and more recent observations, frequently extend down to our latitudes.² Recently the interest of meteorologists has been awakened by the phenomenon of a peculiar stratification which so subdivides the whole column of air above us that the characteristic meteorological elements, especially temperature and amount of aqueous vapor suddenly change their values in passing from one stratum to another. These stratifications are of the greatest importance for the formation of clouds and consequently for climatological conditions. In balloons one can as a rule perceive very clearly when a new stratum is entered; a sudden change in direction and velocity of movement generally accompanies this transition, due to the different direction and velocity of the wind in the new stratum. Now, it is noteworthy that with each entrance into a new stratum there has been observed a sudden change in the electronic charge and also in the proportion in which the positive and the negative charges are mixed in these strata. Therefore just as each stratum is characterized by a certain temperature and moisture so it is also characterized by certain electrical properties which seem to be conditioned chiefly by its origin. Thus, the strata flowing from

the Alps are quite differently constituted electrically from the currents flowing toward the mountains.

But balloon investigations into the electronic charge of the higher layers of the atmosphere should be of interest for other very different reasons also. According to the profound investigations of C. T. R. Wilson it can no longer be doubted that the electrons existing in the air play an important part in all processes of atmospheric condensation. By repeated alternate condensations and expansions of air saturated with water vapor and contained in a large closed space, Wilson freed the air of dust, since the fine particles of the latter serve as centers of condensation and sink with the cloud of mist which forms. Even after this clarification, however, renewed condensation occurred when the supersaturation by the aqueous vapor reached either one of two well-defined limits. It further appeared that these limits were the same and were much more distinctly marked if the inclosed sample of air were artificially ionised by Röntgen, Becquerel, or ultraviolet rays, and that it is *the electrons themselves* which serve as centers of condensation. Of special importance is the fact that the aqueous vapor condenses more readily, i. e., at a lower degree of supersaturation, upon the negative than upon the positive electrons, and consequently that during progressive condensation, first the negative and then the positive particles are precipitated. Recent meteorological investigations have shown that extensive supersaturations are not rare, even in the free atmosphere; therefore the charge of free electrons present in a layer of air in which condensation has just begun must be of great importance in the formation of clouds in that stratum. We must conclude that three classes of nuclei for condensation are present in our atmosphere. The first class consists of dust particles upon which the aqueous vapor is precipitated at the least approach to supersaturation; as these water-laden particles fall to the ground they form therefore a precipitation that is electrically neutral. As the result of a further condensation of the aqueous vapor the second class of condensation centers or the negative electrons become nuclei and the precipitation that reaches the earth's surface brings with it negative charges. Only after supersaturation has proceeded very far will positive charges be brought down (by positive electrons) from the higher atmospheric layers. This explains the varying signs of the electric charges which the atmospheric precipitation shows in a rain shower or in a thunder-storm. At first the signs may be electrically neutral in spite of higher electric tensions at the ground. Lenard found electrically neutral particles among those produced in gases by ultraviolet rays; the mist clouds which he generated in air saturated with water vapor by the passage of ultraviolet radiation showed themselves not to be electrically charged, but neutral, as they descended upon a metal plate connected with the electrometer. However, the thorough investigations by Elster and Geitel, into the electrical nature of the atmospheric precipitations which have been carried on with all the precautions so urgently necessary for such experiments when conducted in the open air, have demonstrated beyond all doubt the preponderance of negative charges. For example, when dew forms on a morning following a clear night the number of negative electrons on the earth's surface decreases.

Our own countings of electrons on the ground, as well as in the upper air strata, furnish the data for approaching nearer to the question from the quantitative side also. In the stratum of cumulus clouds, at about 2000 meters above sea level, we have repeatedly found charges of electrons exceeding those on the earth's surface fourfold and even more. At the surface of the earth under our normal weather conditions there are from one to three electrostatic unit charges of free electricity per cubic meter, with somewhat more free positive charges than free negative as already stated. With increasing altitude this unipolarity becomes more and more equalized, and is ac-

²Munich is in latitude 48.2° north.—ED.

accompanied by a simultaneous increase in the absolute amount of the charge; at an altitude of 3 kilometers we have a charge of more than 4 electrostatic units per cubic meter. For example on the basis of the Elster-Geitel determinations of the electrical charges in the atmospheric precipitation, V. Conrad (Wiener Berichte, 111, Abth. IIa, p. 342, 1902.) has computed that the amount of electricity in 1 gram of the water of a cumulus cloud amounts to $1/36$ of 10^{-8} of a coulomb. Within a dense cloud in which the vision could penetrate to a distance of only 18 meters, there was according to Conrad's measurement 5 grams of water per cubic meter, consequently an electric charge of about $1/7$ of 10^{-8} of a coulomb per gram of water. Now if the above-mentioned value of 4 electrostatic units, or $4/3$ of 10^{-9} = $4/30$ of 10^{-8} of a coulomb of negative electricity be assumed as the charge per cubic meter, then even this amount of electricity would suffice to explain quantitatively the observed electricity of precipitation.

In general the process of condensation brings down only a small fraction of the electrons present. Suppose now that we consider that only the negative electrons take part in the precipitation, then these are weighted down by coatings of water and sink down as rain, but according to our measurements about an equal quantity of positive electricity per cubic meter remains behind in the cloud. Now as Conrad has already shown, if, for instance, we suppose a cumulus cloud of spherical form of only 1 kilometer radius to rest with its center 3 kilometers from the earth's surface, then it will by its own internal charge cause a decrease of potential at the earth's surface of about 11,000 volts per meter of vertical distance. Now, such values have been actually observed in thunderstorms at the earth's surface. If we reflect that for such a gradient a point in the air of 500 meters above the earth would show a difference of tension of 5,500,000 volts with respect to the earth, then we find ourselves here brought to consider tensions such as we see relieved by the mightiest electric process of the atmosphere, i. e., the thunderstorm. As early as 1887 Lins³ had calculated the immense electrical forces called into being when the charges assumed by him to exist in a cloud, were separated by great stretches of space, and showed that sources of energy were here revealed to us, which were more than sufficient to explain the most violent phenomena of thunderstorms. The theory of electrons now gives us, as we have shown, a surprisingly simple explanation of these charges, and our electron traps deliver to us catches whose magnitudes are quite sufficient to explain the phenomena in a quantitative way. And now finally the last problem, the one which offered altogether insurmountable difficulties to all the old theories, begins to gradually become resolvable from the standpoint of the new theory, viz., the problem of the permanent charge of the earth and the existence above it of a field of electrical tension, or the so-called "fine weather electricity."

It was clear even to the earlier observers that the earth's surface always possessed an electric charge relative to the atmosphere, even in typical fine weather, when there was no trace of thunderstorm conditions within a considerable radius. At such times the earth's mass showed itself negatively charged as compared with the surrounding air; only during cloudy, rainy weather inclining to thunderstorm formation, would the sign of the earth's charge occasionally reverse, but even then only for short periods. To explain this electric charge proper to the earth itself the most divergent theories have been suggested, but none of them have been proved satisfactory. The properties of the electrons furnish a wholly new point of view from which the problem appears surprisingly simple. The positive and negative electrons are to be distinguished from one another wherever they occur by the different velocities at

which they travel. Under the impulse of a given electrical force the negative electrons are more easily set in motion and they travel much faster than the positive electrons, which seem to be loaded with a greater quantity of inert matter. On the other hand both positive and negative electrons seem to be charged with the same quantities of electricity, which are distinguishable from each other only by their opposite signs. Now if such an electrical particle pass near a conducting surface, such as the earth's surface or that of some conductor in electric contact with the same, then the passing particle induces in the conducting surface a superficial charge of the opposite sign, which attracts the particle to it. This attracting force, which is directly proportional to the square of the charge and inversely proportional to the square of the distance of the particle from the conducting surface, influences both species of electrons in the same way, but the negative are able to respond to the electrical forces more easily and quickly than the positive. Thus, during a unit of time and with equal charges of positive and negative electrons in the air, a larger number of negative than of positive electrons will always reach the conducting surfaces and give up their charges to them. On mountains, tree tops, and similar places this process is of subordinate importance, since on these projections the charges of the negative earth repel the negative electrons and collect, as we have seen above, a preponderating number of positive electrons. There are, however, many spots on the earth's surface where its own charge is without effect in reference to the particles in the air and where, therefore, the inflow of negative electricity can proceed undisturbed. As Elster and Geitel have shown these places are all concavities, particularly those occurring under the leafy roof of the earth's vegetation, which are of the greatest extent, but also the cavities formed by caves, chasms, and fissures. In the latter cases the projecting portions and points form a very perfect electrostatic protection against the electrical field of the earth, which otherwise would hinder the wandering of electricity into the charged ground. We have evidences that the vegetation in particular plays a very important part in the atmospheric electric processes, and that the process above explained is quantitatively sufficient to renew the electric charge of the earth in the manner just described. It is certain that such a renewal of the earth's charge must occur, since the air is not a perfect electric insulator, and the conductivity due to the wandering of the electrons causes a perpetual tendency to equalization of the earth's charge and of the gradient of tension in the atmosphere.

There is still much to be said on the subject of the relation of this latter gradient to the conductivity of the air and the charge of electrons, and there is already a rather extensive collection of observations at hand which opens a series of new and interesting perspectives. A further consideration of this subject on this occasion would lead us too far; but we may rejoice in the fact that in the theory of electrons the processes of atmospheric electricity have acquired a point of view that promises to contribute very much to the solution of problems, some of which are centuries old, and that incites us to the most zealous pursuit of further studies in this much contested field of research.

ABNORMAL VARIATIONS IN INSOLATION.

By MR. H. H. KIMBALL, Assistant Editor, dated April 15, 1903.

In the Comptes Rendus, Paris, March 16, 1903. Volume CXXXVI, pp. 713-715, Monsieur Henri Dufour announced that his observations with a Crova actinometer at Lausanne, Switzerland, indicated a diminution in the amount of solar radiation received at the surface of the earth at that place (latitude $46^{\circ} 33'$) in January, February, and March of the present year, as compared with the average of corresponding months for previous years. This is shown in the following table:

³ See Pellat translated by A. G. McAdie, American Meteorological Journal September, 1885, Vol. II, pp. 215-221, and Park Morrill at pp. 438-445 of the same volume.—ED.

Average solar radiation at noon at Lausanne, Switzerland, in gram-calories per square centimeter per minute.

Month.	1897-1902.	1903.	Difference.
January.....	0.79	0.68	0.11
February.....	0.86	0.71	0.15
March.....	0.89	0.70	0.19

M. Dufour is inclined to attribute this deficiency to the presence of large quantities of volcanic dust in the air as the result of the eruptions of last year in the West Indies.

It is evident that the solar radiation of M. Dufour is the radiation from the sun, as received by us on the earth, after it has been diminished by the very appreciable losses due to absorption and other atmospheric influences. This insolation, as actually measured by physicists, is expressed in gram-calories per square centimeter per minute. It has regular diurnal and annual variations but the abnormal variations are those that we are now considering.

Observations of insolation were made by me for the United States Weather Bureau with an Ångström electrical compensation pyrheliometer, from November 10, 1902, to March 26, 1903, at Asheville and Black Mountain, N. C., at an elevation of about 2200 feet and a latitude of about $35^{\circ} 36'$. There are no previous observations at these points with which to compare results, but it was noted at the time and was the occasion of comment, that the measurements did not increase after December as much as had been expected. The following are the monthly averages for the dates of observation, at noon, in gram-calories per centimeter per minute:

Year and month.	Asheville.		Black Mountain.	
	Insolation.	Mean altitude of sun.	Insolation.	Mean altitude of sun.
1902.		°		°
November.....	1.093	36.2	.....	.....
December.....	0.948	31.2	.....	.....
1903.				
January.....	0.852	33.2	.....	.....
February 1-14.....	0.985	39.3	.....	.....
February 19-March 26.....	.....	0.986	.....	47.8

The complete record will be published as a bulletin of the Weather Bureau.

Observations with a Crova actinometer have been continued for many years at Montpellier, France; in the *MONTHLY WEATHER REVIEW* for April, 1902, Vol. XXX, p. 179, Mr. C. G. Abbot has attributed a marked depression for the years 1884-1886 in the curve of mean annual noon insolation to the presence of large quantities of volcanic dust in the air, due to the eruption of Krakatoa in 1883.

While these conclusions appear to be plausible, particularly in the case of the long-continued depression of 1884-1886, there are other causes that may have contributed to the diminished insolation noted in North Carolina this past winter. The atmospheric conditions and the movement of storms in the United States were abnormal, particularly during March, when an area of high barometer persistently remained off the North Atlantic coast, causing in North Carolina winds from the ocean, much cloudiness, and rain.

It is difficult to distinguish between cause and effect in this case. Was the apparent slowing up of the eastward movement of high areas due to diminished insolation, or was the diminished insolation due to increased absorption and reflection of the heat rays as they passed through the earth's atmosphere? If the latter, was the excessive absorption and reflection due to the presence of volcanic dust in unusual quantities, or to an unusual amount of aqueous vapor in the atmosphere, particularly in the upper strata, due perhaps to local anomalies in the atmospheric circulation?

There seems to be no reason why this latter explanation will

not suffice for the observations made in this country when considered by themselves, but if the insolation was deficient over most of the Northern Hemisphere, and continued to be deficient for a period of several months, then some more general explanation must be sought for. If volcanic dust is the cause, no doubt it will manifest itself in other ways, as, for instance, by causing brilliant after glows following the usual sunset colors. Observations of insolation and of sunsets for the coming months should therefore have special interest for meteorologists.

The following monthly means of insolation observed with the Ångström apparatus at Washington, D. C., at noon on clear days during April, May, and June, 1893, are added as this note goes to press:

Solar radiation, in gram-calories per square centimeter per minute.

Month.	Number of days.	Insolation.
1903.		
April.....	7	1.024
May.....	9	1.022
June.....	4	0.952

HAILSTORMS IN PORTO RICO.

By Mr. W. H. ALEXANDER, Observer Weather Bureau, dated April 30, 1903.

Hailstorms are so rare in Porto Rico that the impression seems to be quite general even among Porto Ricans that they never occur. This is a mistake as was recently demonstrated. The change of season from winter to summer occurs about the middle of April and is, as a rule very marked, being characterized by unusually warm, sultry days, frequent thunderstorms, the setting in of the trades, and in a measure the beginning of the so-called rainy season. This year was no exception unless it be in the unusual strength with which the trades have set in. The records show that from the 11th to the 14th thunderstorms were quite general over the island. The only important, because unusual, feature of the season worthy of special mention was the occurrence of a heavy precipitation of hail on the 12th instant in the vicinity of Caguas. Thinking a report of this might be of interest, effort has been made to secure as full and accurate information relative thereto as possible. Two intelligent gentlemen, one an American and the other a Porto Rican, who were eyewitnesses of the event have been interviewed, and their reports are fully reliable and confirm other information obtained from other sources.

The forenoon of Sunday, April 12, 1903, was warm and sultry, very favorable for the development of thunderstorms. It appears that the storm now under consideration had its beginning about 2 p. m. in the neighborhood of Aguas Buenas, moved eastward along and down the valley of the Bairo River, across the Loiza, and up the valley of the Gurabo. The storm was accompanied by some lightning and thunder and very violent winds, rendered more violent and destructive, no doubt, by the peculiar topography along the storm's track. Some small huts were overturned and considerable damage done to the uncut tobacco along the valley of the Bairo River.

Hail was first observed at Aguas Buenas where, as reported by Mr. Bowser, the fall was light, lasting about ten or twelve minutes, but farther down the river the fall was so heavy that the river bed was "white as snow," so thick were the hailstones. The track of the storm appears to have been just north of Caguas, although hail fell there for about fifteen minutes according to Dr. Lugovino, who was in the city at the time. The precipitation of hail continued as far as Gurabo, but how much farther is not known.

As to the size and form of the hailstones, there are several

reports. At Aguas Buenas they are said to have been small and spherical, melting very quickly after falling. Farther down the Bairo River, near where it is crossed by the military road, an eyewitness says:

The stones were irregular; some being an inch or an inch and a quarter long, some angular or pointed, some round.

The same witness says he found hailstones sometime after the storm between the tobacco rows. Dr. Lugovifio says the stones at Caguas were disk like and melted very soon after reaching the ground. All speak of the manner in which the stones would rebound when first striking the ground.

Some idea of the excitement caused by this phenomenon among the natives may be imagined when it is remembered that there were persons in Caguas over eighty years old who had never seen hailstones. The more simple minded declared that it rained pieces of salt which were "mucho frio." Some were seen next day on the streets exhibiting pieces of stone which they declared were thrown down from the clouds. Specimens of this "petrified hail", to quote Mr. Thomson, were sent to this office, not from Caguas, but from another town, with the statement that they had fallen from the clouds.

The following is translated from *La Democracia* of April 14, a paper published at Caguas, Porto Rico, and refers to the storm of April 12:

Day before yesterday, between 1 and 2 in the afternoon, there swept down upon this city a whirlwind, accompanied by heavy rain and some thunder. Some hail fell, and we are informed that on "La Mesa" (a small hill or mountain known locally as The Table), which is in this precinct, the country people saw traces of snow.

As is seen, since the invasion (of the Americans) to the present time, even our climate has undergone changes, and we are presented with meteorological phenomena unknown and obsolete here. We are progressing.

On the next day (Monday, April 13) there was another hailstorm along the valley of the Loiza River about the same hour of the day. The following extract from the *San Juan News* of April 14 is all the information obtainable relative to this storm, excepting that Dr. Lugovifio said he saw hail fall in Caguas on Monday about 2 p. m.

Yesterday, about noon, there was a terrific storm along the Rio Loiza Valley, between Caguas and Carolina, during which hailstones fell thick and fast. The ground was fairly covered by them and the natives were greatly excited over the event. There have been hailstorms before, but they are by no means usual. The river Loiza rose five or six feet in the four hours it lasted.

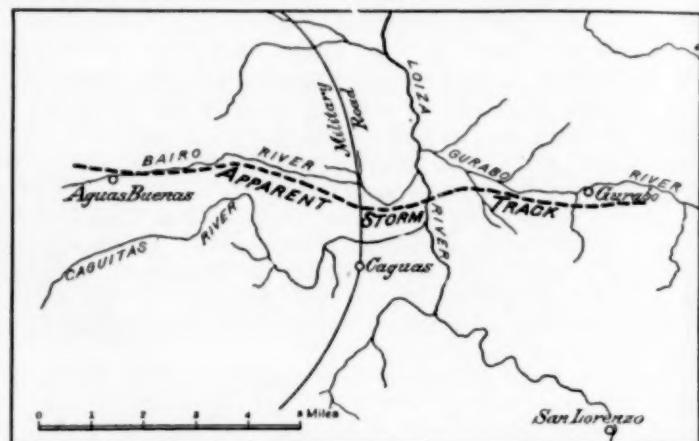


FIG. 1.—Map showing track of hailstorm which occurred on Sunday, April 12, 1903, in Porto Rico.

STAGES OF THE MISSISSIPPI RIVER AT VICKSBURG.

Communicated by Mr. W. S. Belden, Section Director, dated Vicksburg, Miss., June 15, 1903.

The following table of maximum and minimum river stages, in feet, at Vicksburg, Miss., by months, covers the years 1872 to 1903, inclusive. The gage is that established and maintained by the Engineer Corps, U. S. Army, and is in the southern part of the city. The readings are as made by U. S. Weather Bureau river observers. The zero of the gage has never been changed. The danger line is 45 feet. The highest river stage, 52.5 feet, occurred at 1 p. m., April 16, 1897. The lowest river stage, -6.5 feet, occurred on November 13-14, 1895.

Maximum and minimum river stages, in feet, at Vicksburg, Miss., from 1872-1903, inclusive.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
1872	13.6	-0.5	10.9	2.0	20.0	12.0	39.3	19.3	39.5	25.0	32.8	30.4	27.2	17.7
1873	18.4	2.4	37.4	15.8	39.7	29.6	39.9	29.8	40.6	39.1	40.4	33.0	32.5	23.7
1874	34.9	18.0	35.8	29.0	43.0	36.6	45.6	43.1	45.7	43.1	42.8	22.4	22.3	12.1
1875	25.0	8.1	29.8	9.0	41.4	16.7	43.0	41.9	41.8	35.6	34.8	26.0	38.5	28.9
1876	38.8	20.8	42.3	39.0	42.3	38.8	44.3	42.0	44.8	44.2	44.1	37.8	40.0	38.3
1877	33.5	2.1	36.2	19.6	32.8	14.8	41.2	32.9	41.8	40.8	40.8	37.1	39.6	25.5
1878	33.0	24.3	36.6	29.5	41.0	37.0	40.1	29.3	40.6	37.4	39.4	35.5	35.8	21.7
1879	37.0	0	39.5	33.5	40.4	27.6	35.3	33.8	33.3	15.4	18.9	14.8	20.8	12.4
1880	39.9	30.9	40.0	27.3	42.9	39.0	43.2	41.8	41.7	25.1	26.5	22.5	34.3	23.8
1881	30.3	9.0	40.8	26.6	41.8	40.7	41.3	40.9	41.6	39.8	39.5	25.0	31.9	19.9
1882	42.8	34.6	44.7	42.9	48.8	44.5	47.1	43.0	42.8	41.2	41.5	41.2	41.0	36.3
1883	22.6	11.7	42.2	24.6	43.4	42.3	43.8	42.3	42.3	37.6	39.8	38.4	39.6	31.4
1884	36.2	23.9	44.4	30.7	49.0	45.0	47.7	45.2	45.8	42.0	41.3	30.1	29.6	19.3
1885	42.3	17.2	42.4	28.6	34.6	22.5	37.0	28.3	40.9	33.1	32.7	35.7	19.8	15.5
1886	28.1	16.9	37.7	23.7	39.0	24.2	43.7	28.1	44.2	41.9	41.9	25.4	30.3	17.3
1887	17.3	8.0	41.9	18.0	44.7	42.1	44.6	22.1	38.2	25.9	24.9	15.9	18.9	7.5
1888	26.3	-1.3	24.8	19.7	30.8	24.4	44.2	32.5	43.6	27.4	34.9	28.8	30.0	25.5
1889	33.8	13.1	33.2	20.8	33.6	25.5	30.2	23.0	26.1	13.1	33.4	19.2	34.4	21.0
1890	41.5	19.1	46.2	42.0	48.0	46.3	49.1	46.3	48.5	41.4	41.3	28.9	28.5	13.0
1891	33.6	11.8	43.2	28.2	48.0	45.5	48.1	47.3	47.3	18.5	29.3	17.5	29.4	17.7
1892	28.9	16.6	32.8	21.1	33.6	28.0	47.2	32.9	48.4	47.4	48.4	46.6	37.7	36.6
1893	22.4	6.3	38.0	6.2	42.4	38.3	40.8	30.0	48.3	41.4	46.7	42.3	41.4	15.0
1894	17.4	6.2	40.3	16.3	40.8	32.8	40.9	34.5	35.8	24.4	25.8	17.2	17.0	7.4
1895	29.1	1.0	28.5	1.4	30.6	1.4	31.7	19.1	24.1	10.2	12.1	6.7	19.1	9.3
1896	28.2	9.0	32.6	9.1	30.0	17.7	39.0	28.6	27.4	17.5	33.4	19.8	27.2	18.5
1897	26.7	9.7	33.3	18.0	49.4	32.8	52.5	40.2	51.9	44.2	43.4	18.1	24.0	15.2
1898	39.2	7.9	43.0	26.0	38.5	19.2	49.4	39.4	47.8	41.9	42.0	27.8	27.0	13.4
1899	39.6	15.2	39.6	28.5	44.8	29.8	47.3	45.0	45.6	37.4	37.1	27.4	26.7	10.3
1900	20.1	4.6	30.4	12.3	38.0	27.9	36.6	28.9	34.0	17.7	28.1	17.5	32.5	13.8
1901	23.9	10.9	21.6	14.4	32.0	7.9	39.9	31.2	41.5	21.9	27.8	19.2	24.8	9.0
1902	25.2	6.6	31.4	8.3	40.8	12.9	41.2	33.3	32.2	14.5	25.4	17.4	29.6	19.3
1903	39.8	23.0	44.2	21.0	51.8	44.3	51.3	45.1	45.0	30.7	43.1	31.4	.....	.....

NOTES AND EXTRACTS.

COLD WEATHER IN THE ARCTIC AND TEMPERATE ZONE.

The records received early in 1903 from the Klondike region showed that an unusually long cold spell was prevailing in that region accompanied by calm air and at the beginning clear weather gradually changing to a dense cold fog. This was apparently the edge of an unusually extensive area of cold air in northern America. From this region there has been a steady flow of north winds and dry cold air up to the middle of May. As an inevitable result, immense quantities of icebergs, floes, and field ice have drifted down from Davis Straits and extensive ice fields have been passing out of the Gulf of St. Lawrence. A correspondent of the London Post states that the British Meteorological Office has for a year past been investigating the variations in the temperature of the surface water of the Atlantic, and that "about the middle of December, a singular change of temperature was detected near the fiftieth parallel of latitude, between longitudes 20° and 40° west where instead of a water temperature of 50° or 60° the thermometer dropped below 40°, and even 32° F. over regions of deep water." He adds that it is a question whether "similar abnormal fluctuations of water temperature in this region are a sort of measure of the character of the coming ice drift from the Arctic down to Newfoundland."

METEOROLOGY AT THE NEXT MEETING OF THE FRENCH ASSOCIATION.

In connection with the approaching meeting of the French Association for the Advancement of Science, to be held at Angers on the 4th of August, 1903, the president of the meteorological section, Mr. B. Brunhes, Director of the Meteorological Observatory of the Puy de Dome, Clermont-Ferrand, France, makes the following announcement:

Called to preside over Section VII of the Congress, I have the honor to beg you to kindly lend your cooperation to the work of this section, either by assisting at the Congress in person, or, if that is not possible, by at least sending a communication on some subject bearing on the meteorology and physics of the globe.

Full liberty is given you in the choice of your subject, provided that it relates to the science of the atmosphere and to terrestrial physics in their most general acceptation. Memoirs relative to seismic phenomena, terrestrial magnetism, and atmospheric electricity will be especially acceptable.

In order to conform to traditional usage, I take the liberty of placing before you two propositions in meteorology, on which it would be especially interesting to receive reports and possibly to publish them.

1. Forecasting of storms by a process based upon the use of radio conductors. [i. e. Natural signals caught by the apparatus used in wireless telegraphy.—ED.]

2. Origin, direction of rotation, method of propagation and destructive effects of aerial cyclones in the temperate regions and of vortices in currents of water.

Recent important works have directed attention to the analogies and differences between the vortex motions produced in air and in water, on the one hand and on the other hand to the damage caused by running water, and to the various possible explanations of the want of symmetry observed in its action upon the opposite banks of the rivers of our regions. Every accurate and well made personal observation relating to these subjects would be most valuable, however brief it might be, or however insignificant it might appear to the author.

If the communications presented are of sufficient importance to render the discussion so interesting as to attract the attention of persons belonging to other sections of the Congress. I will arrange with the presidents of these sections, notably of the section of pure physics and that of geography, to form joint sessions of the sections interested.

Therefore, whether you desire to devote your contribution to the study of either of the two subjects mentioned, or to treat of a different subject, I will be very grateful if you will communicate to me immediately, or, if it be possible, within a month or six weeks, the title of the papers that you propose to submit to the Congress in order that they may be included in the first provisional program of the business of the session, which will be published shortly.

NOT A TORNADO ON MAY 26.

Under date of May 27, 1903, Mr. George M. Chappel, Local Forecast Official, Des Moines, Iowa, writes as follows:

Referring to articles in this morning's Register and Leader relative to the storm which passed over this city on May 26, I have to say that the statements are overdrawn—that is, in regard to the character of the storm. It was nothing more than a thunder squall, the wind attaining a velocity of 38 miles per hour from the northwest. Personal examination by Mr. J. R. Sage and myself shows that there is positively no indication of any of the characteristics of a tornado. The section of the city where most of the damage was done is known as South Des Moines, being on the south side of the Raccoon and Des Moines rivers. There is a high bluff about 1500 to 2000 feet south of the river, which runs parallel with the river east and west. The wind, coming from the northwest, was deflected by this bluff, and the small, light structures near the base of the hill were demolished. There was no damage done to any substantial, well constructed buildings, except having some window glass broken.

EXHIBITION OF METEOROLOGICAL APPARATUS AT SOUTHPORT, ENGLAND.

Mr. W. N. Shaw, Director of the Meteorological Office, London, announces that—

In connection with the meeting of the International Meteorological Committee at Southport during the session of the British Association in September next, it is proposed to make arrangements for an exhibition of meteorological appliances and other objects of meteorological interest.

Upon the initiative of the Meteorological Council, with the cooperation of the Royal Meteorological Society and the Scottish Meteorological Society, who have appointed representative members, a committee has been formed to carry out this proposal.

In order to divide the work of collection and organization, it is proposed to group the exhibits into four classes. Those who are willing to cooperate are requested to communicate at once with the gentlemen named below, who have kindly undertaken to receive, on behalf of the committee, intimations and suggestions as to objects of meteorological interest proposed for exhibition:

- A. Meteorological Statistics, Dr. H. R. Mill, 62 Camden Square, London, NW.
- B. Weather Telegraphy, Mr. W. N. Shaw, 63 Victoria street, London, SW.
- C. Atmospheric Physics, Capt. Wilson Barker, H. M. S. Worcester, Greenwich, Kent.
Including (a) Meteorological photography.
(b) Instruments and instrumental records.
(c) High-level stations, balloons, and kites; observations and records.
(d) Experimental illustrations.
- D. The relation of Meteorology to other branches of Physics, Mr. A. R. Hinks, The Observatory, Cambridge, England.

INTERNATIONAL AERIAL RESEARCH.

According to Nature, May 28, 1903, "international scientific balloon ascents were made on the morning of March 5; some of the balloons were manned and others equipped with recording instruments only, while at some stations kites were used. We quote only the preliminary results of the registering balloons, as these attained the greatest altitudes. At Trappes, near Paris, a temperature of -49.8° C. was registered at 10,000 meters; the reading at starting was 9.6° , and an inversion of 0.2° occurred at 750 meters. The balloon rose to 15,700 meters, but as readings at higher altitudes than those quoted are suspected of being vitiated by radiation, they are scrupulously rejected. At Strasburg the temperature at starting was 6.3° , and the following readings were recorded: -59.1° at 15,600 meters; -54.0° at 10,300 meters; -51.5° at 12,200 meters. A second balloon on March 6 recorded -62.1° at 15,330 meters; -51.2° at 10,200 meters, and -48.2° at 11,300 meters. At Berlin the following temperatures were recorded: -57.0° at 10,400 meters; -51.0° at 12,000 meters; at starting 4.4° . The type of weather was cyclonic over the British Isles and west of Scandinavia, and anticyclonic over southwest France and eastern Russia."

CURRENTS IN SANDUSKY BAY.

Mr. E. L. Mosely, of the High School at Sandusky, Ohio, has published a paper in the eleventh annual report of the Ohio State Academy of Science, in which he gives the results of his investigation of the currents in Sandusky Bay and the adjacent lake. By placing tightly corked bottles at various points along the shore of the bay and observing where they finally rested, he has been able to show the influence of the wind on the movement of the water. Each bottle was fastened to a board about six inches square. When the bottle was empty, both board and bottle floated on the surface and were directly affected by the winds, but by weighting the bottles with sand the wooden float could be completely immersed in the water; the wire connecting the bottle and the float could be so adjusted as to bring the bottle at any level below the surface of the water. Eighty bottles were set adrift between July 26 and December 6, 1902. Of these 44 had been found before the freezing of the bay in December. Mr. Mosely says:

The courses taken by the floats depend so closely upon the direction and velocity of the wind for some time before and after the bottle is put in that, with some experience, it will be possible to predict from the wind record what course the bottle will take. The bottle may go against the wind or may make a large angle with it. So long as it remains in the bay its course largely depends upon whether the water is rising or fall-

ing, and this, in turn, depends mainly upon the wind. If for several days the wind does not vary much in velocity or direction, the level of the bay adjusts itself to it, and no marked change of level will occur until the wind lessens or increases in force or changes in direction. If strong westerly winds have prevailed for some time and within twenty-four hours change to east or northeast, a strong current sets into the bay, while a reverse change of the wind will cause a strong current outward. At any point in the bay the current depends partly on the position with reference to shores or shoals, partly on the direct action of the wind on the water in that part of the bay, but chiefly on whether at the entrance to the bay the water is entering or leaving. These three factors affect both the direction and velocity of the current.

Strong winds and sudden changes of wind seem to make swifter and deeper currents, but it is difficult to get at the velocity of any current by this method of observation since we do not know accurately the time at which a float arrives at a given point. The influence of the jetties and of the changes of wind and of the general configuration of the shore lines, both of the lake and the bay, seems to be well made out. Mr. Mosely says:

Brisk southwest winds often lower the water in the bay as much as 2 feet, and brisk northeast winds raise it that much above the usual level. Assuming the average depth of the entire bay to be 9 feet, a southwest wind will reduce it to 7 feet. A northeast wind following this may raise the level to 11 feet, and so bring into the bay from the lake more than half as much water as the bay contained a few hours before.

THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, Forecast Official, in charge of Division of Meteorological Records.

CHARACTERISTICS OF THE WEATHER FOR MAY.
PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart IV and the average values and departures from normal are shown in Tables I and VI.

The mean pressure was highest over southern New England and the northern part of the Middle Atlantic States, and lowest over Arizona and New Mexico.

It was below the normal in western Minnesota, the Dakotas, eastern Nebraska, eastern Montana, southern Florida, Louisiana, and western Arkansas, and thence westward and northwestward to the central valleys of California. The departures, however, were small, the greatest occurring over western North Dakota and eastern Montana, and were less than .10 inch. In the remaining districts the mean pressure was above the normal, with decided departures, + .15 to + .17 inch, over New England and the northern portions of the Middle Atlantic States.

The mean pressure increased over that of April, 1903, in the Atlantic States, except southern Florida, the northern portion of the east Gulf States, the Ohio Valley and Tennessee, upper Mississippi Valley, and Lake region, and over western Washington; elsewhere it decreased from that of April, 1903, with but slight departures, the greatest being - .10 inch to - .12 inch, and occurred over the central valleys of California and southwestern Arizona. Over southern New England and the northeastern part of the Middle Atlantic States the increase in pressure over that of April ranged from + .25 inch to + .28 inch; and also was quite marked from North Carolina northward and from eastern Kentucky, western Ohio, and southeastern Michigan to the Atlantic Ocean.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart VI.

The temperature was above the normal in north-central California, and from western North Dakota, South Dakota, and central Nebraska eastward, and southeastward over central North Carolina, to the Atlantic Ocean, except over the western portion of Lake Superior; elsewhere it was below the normal. Over the Middle Atlantic States, Ohio Valley, central Mississ-

ippi Valley, eastern upper Lake region, and the lower Lake region the excess of temperature was quite marked, ranging from an average of + 1.6° to + 4.7° per day. Over the southern portion of the east Gulf States, northern Florida, and from Louisiana and Texas northwestward to and beyond central and western Montana and northeastern Idaho the minus departures were rather marked, although they were not as large as in the region of excess of temperature. By geographic districts the greatest plus departures occurred in the lower Lake region, and averaged 3.4° per day; and the greatest minus departures in the middle Plateau region where they averaged 3.0° per day.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England	8	55.3	+ 1.4	+ 14.9	+ 3.0
Middle Atlantic	12	63.4	+ 1.8	+ 15.2	+ 3.0
South Atlantic	10	69.4	- 0.2	+ 5.7	+ 1.1
Florida Peninsula*	8	74.8	- 1.1	+ 4.8	+ 1.0
East Gulf	9	70.8	- 1.6	- 3.7	- 0.7
West Gulf	7	70.7	- 1.9	- 4.3	- 0.9
Ohio Valley and Tennessee	11	67.8	+ 2.7	+ 8.0	+ 1.6
Lower Lake	8	60.1	+ 3.4	+ 15.5	+ 3.1
Upper Lake	10	54.2	+ 2.8	+ 17.1	+ 3.4
North Dakota*	8	54.7	+ 1.8	+ 8.1	+ 1.6
Upper Mississippi Valley	11	64.0	+ 2.5	+ 11.6	+ 2.3
Missouri Valley	11	61.7	+ 1.5	+ 7.5	+ 1.5
Northern Slope	7	52.1	- 1.4	+ 1.0	+ 0.2
Middle Slope	6	60.4	- 1.6	- 2.0	- 0.4
Southern Slope*	6	66.1	- 2.8	- 6.2	- 1.2
Southern Plateau*	13	62.5	- 2.0	- 7.7	- 1.5
Middle Plateau*	8	53.2	- 3.0	- 17.5	- 3.5
Northern Plateau*	12	53.8	- 1.2	- 0.3	- 0.1
North Pacific	7	52.4	- 1.4	- 2.5	- 0.5
Middle Pacific	5	58.0	- 0.5	- 6.2	- 1.2
South Pacific	4	61.4	- 1.0	- 3.5	- 0.7

* Regular Weather Bureau and selected voluntary stations.

East of the one hundred and fifth meridian the isotherms of 60° and 70° lay considerably to the southward of their location in May, 1902. The isotherm of 90° of maximum temperature, as a rule, was to the southward of its position in May, 1902, yet maximum temperatures of 100°, or slightly higher,

occurred in the central parts of Georgia and South Carolina, which was not the case in May, 1902. Maximum temperatures of 100° , or higher, occurred in western Arizona, southeastern Nevada, and south-central and southeastern California; and of 110° to 112° in west-central Arizona and southeastern California. Freezing temperatures generally occurred, except in the Middle, South Atlantic, and Gulf States, Tennessee, central Ohio Valley, parts of the southern slope and southern Plateau regions, along the Pacific coast, and in Oregon.

In Canada.—Prof. R. F. Stupart says:

The mean temperature of May was, as in March and April, above average from Manitoba to the Maritime Provinces, the largest excess again being in Ontario and Quebec, and the greatest positive departure reported, 7° at Parry Sound. To the westward of Manitoba, it was, on the contrary, lower than average with the largest negative departures, from 4° to 5° , in eastern Alberta. In British Columbia the negative departure was between 1° and 3° .

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The distribution of precipitation was very unusual. In the northeastern part of Florida it was from 2.0 inches to 10.8 inches above the normal while in southern Florida it was somewhat more than two inches below normal. Precipitation 8.0 inches to 13.0 inches above the normal for the month also occurred in southwestern Missouri, eastern Kansas, southeastern Nebraska, and west-central Iowa.

The precipitation was below the normal in southern Florida, central Mississippi, Louisiana, Texas, the slope, Plateau, and Pacific districts generally, central Mississippi Valley, Ohio Valley, northeastern Tennessee, the northern portion of the South Atlantic States, Middle Atlantic States, New England, lower Lake region, and the southern portion of the upper Lake region; elsewhere it was above the normal, and in portions of the South Atlantic and east Gulf States, and the Missouri Valley and contiguous territory the monthly amounts were very large, in one instance amounting to 18.5 inches.

The total snowfall for the month ranged from trace to 4.0 inches in scattered places in the Lake region, and from trace to 37.0 inches in the western mountains.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 13, 14, 20, 29, 30, 31. Arizona, 3, 4, 15, 17. Arkansas, 19, 26, 27, 28, 30. California, 3, 20, 21, 23. Colorado, 5, 6, 9, 10, 15, 17, 21, 24, 25, 26, 27, 28. Connecticut, 7. Florida, 3. Georgia, 1, 3, 4, 6, 15, 27, 28, 31. Idaho, 9, 15, 16, 17, 19, 20, 25. Illinois, 2, 23, 24, 25, 26, 27, 31. Indiana, 15, 19, 21, 25, 26, 27, 28, 31. Indian Territory, 5, 19, 20, 27, 28. Iowa, 9, 10, 12, 13, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28. Kansas, 2, 4, 5, 6, 9, 16, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29. Kentucky, 16, 19, 27, 28, 29. Louisiana, 6, 9, 29, 30. Maine, 19. Maryland, 22, 23, 24, 27. Massachusetts, 13, 14, 19, 28. Michigan, 4, 17, 20, 23, 25, 26, 27, 29. Minnesota, 10, 12, 18, 19, 20, 22, 23, 25. Mississippi, 7, 8, 14, 20, 29, 30, 31. Missouri, 2, 5, 9, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29. Montana, 1, 4, 8, 9, 23, 24. Nebraska, 3, 5, 9, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30. Nevada, 16, 17, 20, 21, 23, 24. New Jersey, 5, 19, 28. New Mexico, 4, 5, 6, 9, 10, 15, 26, 31. New York, 1, 7, 14, 18, 19. North Carolina, 3, 4, 23, 24, 25, 28. North Dakota, 5, 16, 18, 22, 23. Ohio, 22, 23, 24, 25, 26, 27, 28. Oklahoma, 11, 18, 19, 21, 22, 23, 24, 25, 26, 28. Oregon, 7, 15, 16, 18, 21, 22. Pennsylvania, 14, 18, 22, 24, 28. Rhode Island, 19. South Carolina, 2, 3, 4, 5, 26, 27, 28. South Dakota, 3, 4, 8, 9, 16, 17, 18, 20, 21, 22, 24, 25, 26, 28, 29. Tennessee, 3, 6, 18, 20, 28, 29, 30, 31. Texas, 5, 6, 7, 9, 10, 11, 12, 15, 16, 21, 27, 28, 29, 30. Utah, 14, 16, 17, 18,

20, 21, 22, 23, 24, 25, 26, 27. Virginia, 2, 3, 18, 22, 23, 24, 25, 26, 29. Washington, 6, 14, 15, 16, 18, 19, 20, 21, 23. West Virginia, 3, 22, 23, 24, 25, 26, 31. Wisconsin, 1, 5, 11, 17, 19, 23, 27. Wyoming, 5, 10, 16, 17, 18, 21, 22, 24, 27, 28.

SLEET.

The following are the dates on which sleet fell in the respective States:

California, 17, 21. Colorado, 1, 21. Idaho, 1. Iowa, 1. Montana, 1, 8, 15, 16, 17, 18, 19, 20, 22, 23. New York, 1. South Dakota, 21. Utah, 16, 17, 18, 21, 22, 25, 27. Washington, 10, 14, 20. Wyoming, 1, 17, 18, 22, 29.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percent-age of normal.	Current month.	Accumulated since Jan. 1.
New England.....	8	0.80	23	-2.7	-0.6
Middle Atlantic.....	12	1.26	34	-2.4	-1.4
South Atlantic.....	10	4.04	103	+0.1	+1.3
Florida Peninsula *.....	8	4.66	139	+1.3	+7.4
East Gulf.....	9	3.23	76	-1.0	+2.5
West Gulf.....	7	3.35	77	-1.0	-0.5
Ohio Valley and Tennessee.....	11	3.42	90	-0.4	-0.3
Lower Lake.....	8	1.45	42	-2.0	0.0
Upper Lake.....	10	3.12	94	-0.2	-0.4
North Dakota *.....	8	2.95	137	+0.8	-0.8
Upper Mississippi Valley.....	11	5.14	121	+0.9	+0.3
Missouri Valley.....	11	6.91	168	+2.8	+1.8
Northern Slope.....	7	2.17	91	-0.2	-0.3
Middle Slope.....	6	5.97	167	+2.4	+2.2
Southern Slope *.....	6	4.18	87	-0.6	+0.3
Southern Plateau *.....	13	0.50	83	-0.1	-0.2
Middle Plateau *.....	8	1.30	108	+0.1	+0.1
Northern Plateau *.....	12	1.13	59	-0.8	-3.1
North Pacific.....	7	2.16	78	-0.6	-6.8
Middle Pacific.....	5	0.35	23	-1.2	-3.3
South Pacific.....	4	0.04	12	-0.3	+0.5

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The rainfall of the past month has been in excess of the average throughout the Northwest Territories, Manitoba, and New Ontario, and below the average in all other portions of the Dominion, except in a few localities near Lake Erie. In the extreme eastern portions of Ontario and in western Quebec the deficiency has been unprecedented in May, only a few very light showers having occurred, aggregating but a small fraction of an inch. In the more western and southern parts of Ontario the deficiency was by no means so pronounced, and a copious rainfall on the 26th and 27th, extending eastward to about Peterboro and Port Hope, did much good. In eastern Quebec and in New Brunswick the fall was very generally something over an inch, but in Nova Scotia, excepting Cape Breton and in Prince Edward Island it was still more scant, and in some districts only amounted to a few tenths of an inch.

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
			Districts.	Average.	Departure from the normal.
New England.....	71	-7	Missouri Valley.....	71	+6
Middle Atlantic.....	69	-3	Northern Slope.....	69	+6
South Atlantic.....	76	+2	Middle Slope.....	64	+8
Florida Peninsula.....	73	-3	Southern Slope.....	66	+5
East Gulf.....	78	+7	Southern Plateau.....	32	+3
West Gulf.....	77	+2	Middle Plateau.....	46	0
Ohio Valley and Tennessee.....	66	-2	Northern Plateau.....	55	-2
Lower Lake.....	65	-6	North Pacific.....	78	+1
Upper Lake.....	72	0	Middle Pacific.....	63	-5
North Dakota.....	59	-3	South Pacific.....	70	+1
Upper Mississippi Valley.....	71	+3			

The relative humidity was normal in the upper Lake and middle Plateau regions; below in New England, Middle Atlantic States, Florida Peninsula, Ohio Valley and Tennessee, lower Lake region, North Dakota, and the northern Plateau and middle Pacific districts, with marked departures in New

England, the lower Lake region, and the middle Pacific districts; elsewhere it was above the normal, with decided departures in the east Gulf States, Missouri Valley, and the slope districts.

SUNSHINE AND CLOUDINESS.

The cloudiness was above the average in the South Atlantic and Gulf States; the upper Mississippi and Missouri valleys; the slope and northern Plateau regions, and the North Pacific and South Pacific districts; elsewhere it was below the average.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	3.6	- 1.9	Missouri Valley	5.6	+ 0.2
Middle Atlantic	4.2	- 1.0	Northern Slope	5.5	+ 0.1
South Atlantic	5.2	+ 0.8	Middle Slope	5.9	+ 1.1
Florida Peninsula	4.1	- 0.4	Southern Slope	4.8	+ 0.3
East Gulf	5.8	+ 1.5	Southern Plateau	3.0	+ 0.8
West Gulf	5.5	+ 0.6	Middle Plateau	4.0	- 0.1
Ohio Valley and Tennessee	5.0	- 0.1	Northern Plateau	5.0	- 0.6
Lower Lake	3.7	- 1.5	North Pacific	6.7	+ 0.8
Upper Lake	5.4	- 0.1	Middle Pacific	2.9	- 1.3
North Dakota	5.1	- 0.2	South Pacific	4.4	+ 0.2
Upper Mississippi Valley	6.0	+ 0.8			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 5690 thunderstorms were received during the current month as against 6425 in 1902 and 2677 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 28th, 411; 22d, 393; 27th, 339; 21st, 332.

Reports were most numerous from: Missouri, 506; Iowa, 441; Nebraska, 374; Ohio, 301.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, Forecast Official, in charge of Division of Meteorological Records.

Table I gives, for about 137 Weather Bureau stations making two observations daily and for about 31 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,800 stations occupied by voluntary and other cooperating observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 7th to 15th.

In Canada: Thunderstorms were reported at Grand Manan, 20, 21; Yarmouth, 21; Father Point, 21, 28; Quebec, 18, 20, 21; Bissett, 18, 19, 21, 27, 28; Kingston, 28; Toronto, 18, 27; White River, 18; Port Stanley, 20, 24, 26, 27, 28; Saugeen, 21; Parry Sound, 21, 26, 27; Port Arthur, 19; Winnipeg, 17; Medicine Hat, 24, 26; New Westminster, 14; Hamilton, Bermuda, 6.

Auroras were reported from Minnedosa on the 24th and 29th.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Bismarck, N. Dak.	21	52	se.	Point Reyes Light, Cal.	6	50	nw.
Buffalo, N. Y.	3	53	sw.	Do.	9	66	nw.
Cape Henry, Va.	22	52	nw.	Do.	10	58	nw.
Do.	60	n.	Do.	14	64	nw.	
Charleston, S. C.	9	53	ne.	Do.	15	89	nw.
Chicago, Ill.	25	72	sw.	Do.	16	94	nw.
Do.	66	sw.	Do.	17	89	nw.	
Columbus, Ohio	22	52	nw.	Do.	18	68	nw.
Do.	50	w.	Do.	19	60	nw.	
Dodge, Kans.	24	60	nw.	Do.	20	58	nw.
El Paso, Tex.	4	52	w.	Do.	21	64	nw.
Fort Worth, Tex.	27	56	s.	Do.	22	59	nw.
Huron, S. Dak.	21	60	se.	Do.	23	55	nw.
Lincoln, Nebr.	26	76	nw.	Do.	26	61	nw.
Miles City, Mont.	8	54	sw.	Do.	27	66	nw.
Minneapolis, Minn.	22	50	se.	Do.	28	66	nw.
Mount Tamalpais, Cal.	10	52	nw.	Do.	31	65	nw.
Do.	55	nw.	Rapid City, S. Dak.	21	56	w.	
Do.	50	nw.	Sioux City, Iowa	9	51	w.	
Do.	56	nw.	Do.	17	50	s.	
Do.	59	nw.	Do.	18	51	sw.	
Do.	90	nw.	Do.	21	72	se.	
Do.	79	nw.	Do.	22	60	s.	
Do.	67	nw.	Tatoosh Island, Wash.	15	51	sw.	
Do.	56	nw.	Valentine, Nebr.	21	76	sw.	
New York, N. Y.	1	54	nw.	Williston, N. Dak.	7	54	w.
North Head, Wash	13	56	se.	Do.	15	56	nw.
				Do.	22	66	e.

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..... 5 10 15 20 25 30 35 40 45 50 60 80 100 120
Rates per hour (ins.)..... 3.00 1.80 1.40 1.20 1.08 1.00 0.94 0.90 0.86 0.84 0.75 0.60 0.54 0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm

of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages; it is prepared by the Forecast Division.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are prepared by the Forecast Division. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest barometric reading at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all by 0.0.

Chart IV.—Sea-level pressure and resultant surface winds. The pressures have been reduced to sea level and standard gravity by the method fully described by Prof. Frank H. Bigelow on pages 13-16 of the REVIEW for January, 1902. The pressures have also been further reduced to the mean of the twenty-four hours by the application of a suitable correction, to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900-1901, pp. 140-164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of Professor Bigelow's Report on the Barometry of the United States and Canada, which can be found in the Annual Report of the Chief of the Weather Bureau for 1900-1901, Volume II. The correction $t_0 - t$, or temperature on the sea-level plane minus the station temperature, by Table 48 of the Barometry Report, is added to the observed surface temperature to obtain the adopted sea-level temperature.

The wind directions are the computed resultants of observations at 8 a. m. and 8 p. m. daily. The resultant duration is shown by figures attached to each arrow.

Chart V.—Hydrographs for seven principal rivers of the United States, prepared by the Forecast Division.

Chart VI.—Surface temperatures; maximum, minimum, and mean of these. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII. Isobars and isotherms at 10,000 feet. The mean monthly station pressure for each station has been reduced to the 10,000-foot plane by entering Table 53, "Reduction of pressure to the sea level, the 3500 and 10,000-foot planes" pages 789-988, Barometry Report, with the temperature argument t corresponding to θ_0 and correcting the station pressure by the reduction $B_0 - B$ after applying the plateau correction, $C \Delta \theta_0 H$, and the corrections for e and $J A$, the argument t being the mean monthly air temperature. This reduction is fully described in Professor Bigelow's Report on the Barometry of the United States and Canada, pages 772 to 786 of the Annual Report of the Chief of Weather Bureau for 1900-1901, Volume II. The reduction for obtaining B_0 may also be found by using gradients from the station pressure to the height of 10,000 feet as set forth on pages 18 and 19, of the MONTHLY WEATHER REVIEW for January 1902.

The isotherms on the 10,000-foot plane have been computed by using the gradients for temperature for each month and station as shown by the Summary Table of Normals, Table 48, Chapter VIII, of Professor Bigelow's Report on the Barometry of the United States and Canada.

Chart IX.—Isobars and isotherms at 3500 feet. The pressure and temperature data entered on this chart are found by the method described for the same data on the 10,000 foot plane.

Chart X.—The total snowfall. This is based on the reports from regular and voluntary observers, and shows the depth of the snowfall during the month in inches. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given.

Chart XI.—Depth of snow on ground at the end of the month.

When there is no snow the last two charts may be replaced by others.

TABLE I.—Climatological data for Weather Bureau Stations, May, 1903.

Stations.	Elevation of instruments.		Pressure, in inches.		Temperature of the air, in degrees Fahrenheit.						Precipitation, in inches.		Wind.		Maximum velocity.		Cloudy days.		Average cloudiness, tenths.		Total snowfall.										
	Barometer above sea level, feet.	Thermometers above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Miles per hour.	Direction.	Date.	Clear days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.			
	Barometer above sea level, feet.	Thermometers above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Miles per hour.	Direction.	Date.	Clear days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.			
<i>New England.</i>																															
Eastport.	76	69	82	30.03	30.11	+.15	55.4	+.1.4	76	29	57	28	41	33	44	41	71	0.83	—2.7	6	7,512	n.w.	32	1	14	11	6	4.5			
Portland, Me.	103	81	117	30.01	30.13	+.16	53.3	—0.3	87	18	62	27	43	43	42	42	65	0.57	—2.6	4	7,353	s.	36	1	20	4	2	3.6			
Concord.	298	70	79	29.81	30.13	+.15	57.6	+.1.0	89	18	72	27	43	43	42	42	60	0.19	—2.6	4	3,949	n.	28	1	19	10	2	3.2	T.		
Northfield.	876	16	60	29.19	30.13	+.16	54.2	+.0.5	84	18	70	18	39	42	48	40	58	0.19	—2.6	4	6,522	s.	34	1	17	12	2	3.5			
Boston.	125	115	181	30.00	30.14	+.16	56.5	+.2.0	88	19	68	34	50	50	52	46	65	0.32	—3.3	6	7,230	sw.	30	1	18	8	5	3.6			
Nantucket.	12	43	85	30.13	30.15	+.16	53.8	+.1.3	77	19	61	36	27	47	25	50	48	84	0.93	—2.6	4	9,225	sw.	41	1	18	5	12	15	4.3	
Block Island.	26	11	60	30.13	30.16	+.17	55.4	+.3.0	81	19	62	38	52	48	21	51	79	0.86	—2.9	6	9,448	sw.	49	1	16	12	3	3.7			
Narragansett.	10	38	—	—	—	—	56.0	+.1.4	85	22	66	32	47	47	29	32	65	0.80	—3.2	4	—	se.	—	21	6	4	—				
New Haven.	106	117	140	30.03	30.15	+.16	59.8	+.2.2	90	20	70	34	2	50	32	52	47	65	0.31	—3.3	4	5,921	s.	33	1	23	6	2	2.2		
<i>Mid. Atlantic States.</i>							63.4	+.1.8	62.2	2	2.9	62	20	50	36	53	47	61	0.15	—3.0	3	6,073	s.	30	1	20	6	5	3.2	T.	
Albany.	97	102	115	30.04	30.13	+.15	60.1	+.1.6	88	18	72	28	42	45	38	40	58	0.19	—2.8	6	4,553	s.	30	1	18	8	5	3.4			
Binghamton.	875	79	90	29.22	30.15	+.17	58.4	+.1.6	61.1	4	4.6	91	20	72	40	56	55	60	67	0.33	—2.8	5	7,398	e.	54	1	15	9	7	4.3	
New York.	314	108	250	29.80	30.14	+.15	61.1	4	4.2	91	18	74	34	52	54	29	55	48	60	0.46	—4.2	7	4,748	se.	33	1	13	8	10	4.8	
Harrisburg.	374	94	104	29.74	30.13	+.15	64.4	+.4.2	91	18	74	34	52	54	29	57	52	70	0.93	—2.3	11	7,158	ne.	36	1	12	9	10	4.8		
Philadelphia.	117	168	184	30.02	30.15	+.16	65.6	+.3.6	92	20	76	36	22	56	29	57	52	70	0.93	—2.3	11	7,158	ne.	36	1	12	9	10	4.8		
Schenectady.	805	111	119	29.29	30.15	+.17	60.8	—	88	19	73	27	49	53	51	43	54	96	0.85	—2.2	5	5,734	sw.	23	16	11	4	3	3.3		
Atlantic City.	52	39	48	30.09	30.15	+.17	59.6	+.2.4	90	20	65	39	24	54	27	56	54	84	0.52	—2.2	5	5,734	sw.	23	16	11	4	3	3.7		
Cape May.	17	47	51	30.14	30.16	+.17	60.1	+.1.5	88	20	66	32	54	23	53	56	60	67	0.42	—3.7	6	4,553	s.	30	1	18	8	5	3.4		
Baltimore.	123	69	117	29.99	30.13	+.14	65.2	+.1.0	92	20	75	37	2	56	29	58	62	67	0.33	—2.8	5	7,398	e.	54	1	15	9	7	4.3		
Washington.	112	59	76	30.01	30.13	+.13	64.4	+.0.5	91	19	75	38	2	52	38	52	58	73	0.75	—1.2	11	6,456	s.	34	1	17	7	7	4.3		
Cape Henry.	18	11	56	30.09	30.11	+.11	64.4	—0.1	90	19	71	48	6	53	27	50	52	73	1.70	—2.4	9	10,133	ne.	60	1	24	10	8	13		
Lynchburg.	681	83	88	29.36	30.10	+.10	66.4	+.0.4	93	24	78	37	2	55	34	58	53	67	1.13	—2.8	7	2,987	e.	30	1	24	13	13	5.5		
Norfolk.	91	102	111	30.03	30.13	+.13	66.0	—0.4	91	20	74	46	6	58	31	60	57	78	2.27	—2.0	8	6,806	ne.	34	1	24	10	15	6.4		
Richmond.	144	82	90	29.98	30.13	+.14	67.8	—	92	21	78	43	2	57	32	50	52	78	1.36	—2.0	10	3,991	ne.	25	1	22	12	9	10		
Wytheville.	2,293	40	47	27.74	30.12	+.13	62.3	—	87	24	75	35	5	50	39	56	52	74	2.85	—2.0	9	3,345	e.	17	1	15	14	2	3.1		
<i>S. Atlantic States.</i>							63.4	—0.2	60.6	—	62.2	—	60	—	60	—	67	—	1.4	—0.1	76	4.04	+	0.1	—	—	5.2				
Asheville.	2,255	53	75	27.78	30.08	+.09	63.8	+.1.2	90	24	74	39	1	53	33	57	54	74	1.14	—2.5	10	5,357	se.	30	1	7	17	7	5.2		
Charlotte.	723	68	76	29.26	30.09	+.10	69.8	+.1.4	95	23	79	51	2	60	27	61	56	68	0.53	—3.8	8	4,902	ne.	35	1	20	8	13	5.4		
Hatteras.	11	12	47	30.10	30.11	+.10	67.8	+.1.4	82	23	73	52	6	63	16	63	61	82	0.43	—0.2	5	9,374	ne.	42	1	11	12	8	4.7		
Kittyhawk.	8	12	30	—	—	—	65.4	—0.6	90	—	72	45	6	59	27	50	52	72	—3.0	10,154	ne.	—	17	10	4	3.5					
Raleigh.	376	93	101	29.70	30.09	+.10	68.8	+.1.3	95	24	79	46	2	58	31	60	55	67	2.67	—1.8	5	4,847	ne.	29	1	9	13	10	4.5		
Wilmington.	78	82	90	29.99	30.07	+.05	69.2	—0.5	92	24	79	47	2	61	27	63	60	78	2.90	—1.3	8	6,795	ne.	32	1	11	12	8	4.9		
Charleston.	48	14	92	30.02	30.07	+.06	71.2	—1.2	94	24	77	53	2	66	23	63	62	79	4.85	—0.8	11	10,081	ne.	53	1	8	13	10	5.7		
Columbia.	351	114	122	29.70	30.08	+.08	71.0	—1.4	97	24	80	53	2	62	26	63	60	74	2.39	—1.5	13	6,188	ne.	26	1	12	9	13	5.6</		

TABLE I.—Climatological data for Weather Bureau Stations, May, 1903—Continued.

Stations.	Elevation of instruments.		Pressure, in inches.		Temperature of the air, in degrees Fahrenheit.								Precipitation, in inches.		Wind.								
	Barometer above sea level, feet.	Thermometers above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with 0.1, or more.	Total movement, miles.	Miles per hour.	Direction.		
	Barometer above sea level, feet.	Thermometers above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. + 2.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with 0.1, or more.	Total movement, miles.	Miles per hour.	Direction.		
<i>North Dakota.</i>																							
Moorhead.	935	54	60	28.93	29.93	-.01	54.2	+.0.6	56.0	+.2.8	85	15	68	28	1	50	39	50	44	1.2	48	se.	
Bismarck.	1,674	16	29	28.13	29.90	-.02	54.6	+.0.4	86	16	67	24	32	40	47	40	61	3.20	+.0.7	6	8,622	n.w.	
Williston.	1,875	14	44	27.87	29.84	-.09	51.9	+.1.3	93	14	65	23	2	39	41	45	38	71	3.94	+.1.9	12	8,587	w.
<i>Upper Miss. Valley.</i>																							
Minneapolis.	99	208	29.25	29.95	-.02	59.1	+.2.3	83	22	68	32	1	50	30	50	44	67	5.50	+.1.2	10	8,012	se.	
St. Paul.	837	102	122	29.05	29.95	+.02	59.4	+.1.9	81	16	68	35	1	51	25	53	47	69	5.28	+.0.9	6	8,529	se.
La Crosse.	714	71	87	29.23	29.99	+.05	61.8	+.2.4	83	16	71	34	3	53	30	55	47	79	6.74	+.3.4	15	5,829	s.
Davenport.	606	71	79	29.32	29.96	+.01	64.2	+.3.5	85	20	73	35	3	55	32	56	51	67	5.52	+.1.2	14	6,249	s.
Des Moines.	861	84	99	29.03	29.95	+.02	62.8	+.2.4	83	22	72	31	3	54	31	56	52	72	10.64	+.5.9	20	7,499	s.
Dubuque.	698	100	117	29.25	30.00	+.05	62.8	+.2.9	83	16	72	33	1	54	32	55	50	68	4.25	+.0.3	18	5,311	se.
Keokuk.	614	63	78	29.29	29.94	+.00	64.9	+.2.3	85	22	74	32	1	56	26	58	54	74	5.56	-.0.5	10	5,824	se.
Cairo.	356	87	93	29.62	30.00	+.04	68.6	+.1.5	86	26	76	39	1	61	26	63	69	77	3.52	+.0.3	15	6,257	s.
Springfield, Ill.	644	82	93	29.31	29.99	+.04	65.4	+.3.0	85	22	75	33	1	58	31	58	54	70	5.28	+.0.3	11	7,197	s.
Hannibal.	534	75	110	29.39	29.96	+.02	65.6	+.2.5	86	22	74	30	1	57	28	55	52	70	5.24	-.0.1	7	5,153	e.
St. Louis.	567	111	210	29.37	29.97	+.02	69.0	+.3.2	92	22	77	39	1	61	27	60	56	68	2.08	+.2.5	14	6,695	s.
<i>Missouri Valley.</i>																							
Columbia.	784	11	84	29.11	29.94	+.00	65.0	+.0.5	86	22	74	30	1	56	34	58	54	75	5.26	+.0.3	17	5,997	se.
Kansas City.	963	78	95	28.92	29.94	+.02	64.5	+.0.3	84	25	72	36	1	56	27	58	54	75	7.67	+.3.0	20	6,345	se.
Springfield, Mo.	1,324	98	104	28.55	29.94	+.01	64.2	+.1.0	83	22	72	32	1	57	29	59	56	79	9.96	+.4.0	16	8,36	w.
Topeka.	81	89	—	—	—	—	63.5	+.0.1	85	22	72	32	1	55	35	58	53	78	8.63	+.3.6	19	7,815	s.
Lincoln.	1,189	75	84	28.63	29.88	-.03	61.3	+.0.2	84	20	70	34	1	52	28	56	52	79	10.72	+.6.3	19	7,578	s.
Omaha.	1,105	115	121	28.74	29.90	-.02	62.9	+.1.2	84	20	72	35	1	54	26	58	55	79	8.32	+.4.0	19	7,204	s.
Valentine.	2,598	47	54	27.17	29.85	-.04	57.7	+.1.9	87	17	69	34	3	46	34	48	41	61	2.41	-.0.4	12	9,877	ne.
Sioux City.	1,135	96	164	28.71	29.92	-.00	60.8	+.2.4	81	17	70	34	1	52	28	58	52	79	11.78	+.8.1	16	10,415	ne.
Pierre.	1,572	43	50	28.24	29.89	-.02	60.2	+.4.6	87	16	72	36	12	48	36	50	42	57	7.72	-.0.6	7	6,864	e.
Huron.	3,006	66	67	28.53	29.92	-.00	58.2	+.3.1	83	17	71	31	3	46	40	50	44	67	9.99	-.1.0	10	9,935	ne.
Yankton.	1,233	42	49	28.59	29.90	-.02	60.2	+.1.7	85	18	71	33	1	50	36	58	52	79	7.60	+.3.3	15	6,728	s.
<i>Northern Slope.</i>																							
Havre.	2,505	46	53	27.26	29.88	-.02	51.1	-.2.2	92	13	63	28	19	39	43	43	64	3.47	+.1.9	12	8,092	sw.	
Miles City.	2,371	42	50	27.36	29.84	-.07	55.7	-.0.7	96	14	68	30	2	43	38	51	48	77	1.07	-.1.2	8	6,470	w.
Helena.	4,110	88	94	25.74	29.94	+.01	49.2	-.2.6	85	13	60	26	18	39	38	39	50	54	1.64	0.0	11	6,578	s.
Kalispell.	2,965	45	51	26.86	29.92	+.04	47.9	-.0.8	88	31	59	28	1	37	41	40	43	64	1.07	-.0.7	13	4,719	s.
Rapid City.	3,234	46	50	26.53	29.87	-.03	53.8	+.0.9	83	14	64	32	2	43	35	46	40	64	1.94	-.0.7	16	6,131	w.
Cheyenne.	6,088	56	64	23.95	29.88	+.03	48.0	-.2.6	77	14	60	24	2	36	43	39	30	57	0.46	-.1.8	9	8,215	w.
Lander.	5,372	26	36	24.57	29.90	+.02	49.0	-.2.0	82	13	62	13	2	36	47	40	32	60	1.86	-.0.4	10	3,584	sw.
North Platte.	2,821	43	52	27.00	29.89	+.01	57.8	-.0.4	86	17	69	34	3	47	37	51	46	73	3.74	+.1.0	15	8,110	n.w.
<i>Middle Slope.</i>																							
Denver.	5,291	79	151	24.65	29.86	+.02	54.9	-.1.5	84	14	68	32	2	42	42	43	32	51	0.75	-.2.1	10	6,632	s.
Pueblo.	4,685	80	86	25.20	29.83	-.00	57.3	-.1.4	83	24	72	30	3	43	46	44	30	53	0.29	-.1.6	2	6,711	se.
Concordia.	1,398	42	47	28.43	29.88	-.03	61.7	-.0.4	86	20	70	35	3	53	31	57	55	83	13.15	+.9.1	20	7,079	s.
Dodge.	2,509	44	54	27.31	29.89	+.02	60.4	-.2.5	87	20	72	34	3	49	41	54	46	78	2.88	-.0.3	16	12,280	s.
Wichita.	1,358	78	86	28.48	29.90	-.00	62.9	-.1.3	84	20	71	34	3	54	29	58	50	80	3.15	+.3.7	16	8,021	s.
Oklahoma.	1,214	79	86	28.61	29.87	-.02	65.0	-.2.8	84	27	73	35	1	57	31	59	56	77	10.79	+.5.3	16	10,314	s.
<i>Southern Slope.</i>																							
Abilene.	1,738	45	54	28.10	29.88	+.01	68.4	-.3.8	91	27	78	36	1	59	36	60	55	70	1.99	-.1.6	5	8,109	se.
Amarillo.	3,676	43																					

TABLE II.—Climatological record of voluntary and other cooperating observers, May, 1903.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Alabama.</i>	°	°	°	In.	In.	<i>Arizona—Cont'd.</i>	°	°	°	In.	In.	<i>California—Cont'd.</i>	°	°	°	In.	In.
Anniston	89	36	67.4	5.69	8.37	Parker	111	46	78.0	T.	T.	Chico	101	40	68.4	0.25	
Ashville	90	38	67.3	6.42		Phoenix	107	39	73.4	T.	T.	Cleco #1	72	26	50.3	0.40	4.0
Benton	94°	48°	70.8°	6.56		Prescott	80	24	54.4	T.	T.	Cloverdale	101	34	63.8	0.00	
Bermuda	90	42	71.0	3.65		San Simon	93	35	66.6	T.	T.	Colusa	96	44	67.6	T.	
Birmingham	90	42	71.0	5.51		Sentinel #1	109	62	84.9	0.00		Corning #1	102	50	66.9	0.15	
Bridgeport				5.60		Signal	112	39	72.9	0.00		Coronado	71	50	62.8	0.06	
Burkeville				5.37		Superstition				0.08		Crescent City	75	35	52.2	1.32	
Calera	93	45	69.2	5.87		Taylor	87	28	58.0	0.45		Crescent City L. H.				1.78	
Camphill	89	49	71.2	2.71		Tombstone	93	45	67.5	0.08		Cuyamaca	73	27	49.8	0.69	
Citronelle	90	40	67.5	5.72		Tuba	93	36	63.0°	T.		Delta #1	100	52	71.4	0.51	
Clanton	91	40	69.3	5.16		Tucson	102	42	70.0	0.20		Drytown	100	36	63.6	0.00	
Cordova	91	37	68.3	5.16		Vail #1	88	59	71.4	0.04		Dunnigan #1	100	54	76.3	T.	
Daphne	89	52	71.4	6.64		Walnut Grove				0.00		Durham	103	37	66.6	0.24	
Decatur	98	40	71.2	5.27		Wilcox	88			1.00		East Brother L. H.				0.00	
Demopolis				5.54		Yarnell				0.05		Ecalajon	88	39	64.4	0.14	
Dothan	97	57	73.2	5.77		<i>Arkansas.</i>	87	30	65.8	6.36		Elmdale	103	35	64.6	T.	
Eufaula	90	47	69.7	9.16		Alco	85	32	66.4	13.31		Elsinore	102	34	63.5	T.	
Eutaw	92°	49°	71.5°	7.06		Amity	85	32	66.4	8.27		Escondido	100	33	63.6	T.	
Evergreen	93	51	71.3	4.29		Arkadelphia	89	34	68.8	3.42		Fallbrook	88	38	61.8	0.08	
Floaton	91	49	70.6	3.95		Arkansas City				10.35		Folsom #1	103	54	69.3	T.	
Florence a.				7.13		Batesville	87	32	68.2	7.78		Fordyce Dam				1.15	8.0
Florence b.	89	38	69.0	6.90		Beebranch	87	32	67.0	8.80		Fort Ross	67	40	53.1	0.01	
Fort Deposit	93	49	70.8	6.24		Blanchard	88	35	69.1	2.34		Foster				0.33	
Gadsden	92	41	68.8	6.14		Camden a				10.35		Georgetown	93	32	60.2	0.70	
Goodwater	91	43	68.4	6.95		Camden b	92	40	71.2	5.78		Gilroy (near)	100	35	59.9	0.00	
Greensboro	90	50	69.5	14.81		Conway	87	33	69.0	5.36		Greenville	95	25	54.8	0.54	
Greenville				7.13		Corning	87	33	68.0	7.33		Hanford	104	50	75.4	0.00	
Haleyville	90	34	69.2	5.40		Dallas	87	31	67.2	7.74		Healdsburg	100	37	64.0	T.	
Hamilton	88	39	68.8			Dardanelle				14.88		Hollister	99	33	59.2	6.00	
Helena				5.53		De Queen	90	32	68.2	7.15		Humboldt L. H.				0.53	
Highland Home	90	50	69.3	6.62		Hardy	87	30	66.3	8.52		Idylwild	85	24	52.4	0.48	T.
Letohatchie				5.95		Dutton				10.35		Imperial	118	51	82.5	T.	
Livingston	91	43	70.1	4.20		Eton	88	32	66.1	12.30		Indio #1	106	60	81.0	0.00	
Lock No. 4	93	40	68.4	7.02		Eureka Springs	88	35	68.5	3.24		Iowa Hill #1	86	36	61.9	0.88	2.0
Madison Station	92	39	68.6	6.76		Fayetteville	86	33	64.2	6.69		Irvine	88	50	65.0	0.02	
Maplegrove	93	38	68.0	6.88		Forrest City	90	35	68.0	5.69		Jackson	94	37	62.5	0.04	
Marion	92	44	70.0	6.75		Fulton				10.35		Jamesstown	97	33	62.4	0.05	
Milstead				4.45		Hardy	87	30	66.3	5.68		Jolon				T.	
Newbern	95	45	71.4	10.67		Helena a				10.35		Kennedy Gold Mine	93	32	57.6	0.00	
Notasulga				7.71		Helena b	90	39	70.1	5.13		Kent	88	39	58.6	0.00	
Oneonta	87	39	66.8	8.63		Jonesboro	89	34	68.6	8.51		King City	103	32	61.1	T.	
Opelika	92	50	70.2	9.38		Lacrosse	86	28	66.6	5.91		Lakeport (near)	88	42	62.8	T.	
Ozark	95	48	71.4	4.33		Lake Village	88	40	69.6	2.45		Laguna Valley				0.54	
Prattville	91	43	69.8	6.36		Lonoke	89	34	69.8	6.92		Laporte	82	27	51.4	0.33	3.2
Pushmataha	92	43	70.6	4.42		Lutherville	85	28	64.0	9.35		Lemoncove	105	42	70.2	0.12	
Riverton	90	34	67.9	7.18		Malvern	87	33	68.6	8.25		Lime Point L. H.				0.00	
Scottsboro	92	40	68.9	5.06		Marianna	89	39	69.8	8.08		Livermore	102	38	62.8	0.12	
Selma	91	48	70.6	5.60		Marvell	88	35	69.9	5.99		Lodi	102	41	64.5	0.00	
Talladega	92	41	67.5	6.76		Mossville	80	29	62.6	14.88		Los Gatos	94	38	60.6	0.00	
Tallasee				4.77		Mountain Home	86	29	66.4	6.87		Mammoth #1	107	50	77.3	0.00	
Thomasville	93	46	71.0	6.10		Mount Nebo	82	35	64.4	11.79		Manzana	100	37	66.6	0.00	
Tuscaloosa	91	43	69.5	6.84		New Gascony	88	34	67.7	3.90		Mare Island L. H.				0.15	
Tuscumbia	92	41	70.0	6.37		Newport a.	90	35	69.4			Marysville	100	44	68.9	T.	
Tuskegee	92	50	71.6	3.97		Newport b.	88	31	68.2	5.19		Meadow Valley #1	85	31	51.7	0.48	3.0
Union Springs	92	52	71.4	4.56		Newport c.	88	31	68.2	5.50		Merced	105	37	66.7	0.00	
Uniontown	89	44	68.6	6.90		Oregon	89	26	65.0	9.99		Mercury				0.00	
Valleyhead	90	39	68.7	7.87		Ozark	89	34	67.9	9.36		Milo				0.00	
Verbenas				7.98		Paragould	89	36	68.0	6.13		Milton (near)	96	44	64.4	0.00	
Wetumpka	93°	48°	70.2°	8.34		Perry	89	33	68.2	7.07		Modesto #1	105	52	68.4	0.00	
<i>Alaska.</i>						Pinebluff	91	37	70.4	4.76		Mohave	95	45	68.7	0.00	
Copper Center	89	23	47.4	6.60		Pocahontas	96	31	67.4	6.13		Mokelumne Hill				0.10	
Fort Liscum	68	30	43.4	2.23		Pond	83	24	64.4	8.57		Montague	97	26	57.0	0.07	
Kenai	64	23	42.6	5.54		Prescott	88	45	70.4	5.80		Monterey	69	50	58.2	0.00	
Sitka	56	32	43.6	3.65		Princeton	85	33	68.6	5.09		Mount St. Helens				0.10	
Tyoonok	68	30	44.8	6.69		Rison	87	31	67.4	3.15		Napa	98	38	62.0	T.	
<i>Arizona.</i>						Rosedale	89	31	68.9	12.24		Needles	109	56	81.8	0.00	
Aqua Caliente	110	49	75.6	0.00		Russellville	89	32	67.9								

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>California—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>Colorado—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>Florida—Cont'd.</i>	°	°	°	Ins.	Ins.
Quincy	87	32	55.8	0.55		Longs Peak	62	3	38.3	1.70	7.0	Orlando	95	57	76.2	2.59	
Redding	96	44	68.0	2.29		Mancos	78	27	50.6	1.12	6.0	Pinemount	98	52	73.5	7.55	
Redlands	95	41	63.4	0.48		Marshall Pass	82	23	48.6	1.66	12.0	Quincy	100	49	72.9	4.73	
Reedley	99	49	71.4	0.04		Meeker	82	23	48.6	0.13		Rockwell	98	54	76.1	4.38	
Repress	96	44	70.6	0.00		Montrose	72	12	43.0	0.20		St. Andrews	91	56	71.7	5.52	
Biovista	98	43	65.2	0.05		Moraine	72	12	46.6	1.03		St. Augustine	91	53	72.2	10.58	
Riverside	94	38	62.8	0.03		Pagoda	76 ¹	22	46.6 ¹	1.03		St. Leo	94	57	74.2	3.12	
Roe Island L. H.	102	39	65.8	0.00		Parachute	89	29	57.6	2.26		Stephensville	94	50	72.6	2.53	
Rosewood	102	39	65.8	0.49		Platte Canon	89	29	57.6	1.51	1.0	Summer	93	51	72.1	2.21	
Sacramento	94	43	65.2	T.		Rangely	83	21	52.8	1.06		Switzerland	94	55	72.0	9.48	
Salinas	83	36	58.0	0.00		Rockyford	87	32	50.1	0.28		Tallahassee	92	59	73.2	5.59	
Salton	116	48	79.1	0.00		Rogers Mesa	83	31	54.2	0.71	0.7	Tarpon Springs	93	58	74.0	2.10	
San Bernardino	98	36	63.8	0.24		Ruby	74	17	44.3	0.20		Titusville	88	57	72.3	7.53	
San Jacinto	99	39	63.3	0.00		Russell	74	17	44.3	0.20		Waukeenah	99	55	73.4	2.37	
San Jose	90	39	61.0	0.00		Saguache	78	21	49.3	0.10		Wausau	98	54	73.5	10.70	
San Leandro	86	40	59.5	0.00		Salida	79	22	49.9	T.		Wewahitchka	94	56	73.4	6.06	
San Luis L. H.	85	36	59.0	0.00		San Juan	76	16	43.0	1.50	12.5	<i>Georgia.</i>					
San Mateo ¹	85	50	60.4	0.00		San Luis	75	18	47.7	0.12		Adairsville	91 ¹	43	71.0 ¹	2.77	
San Miguel ¹	97	42	62.7	0.00		Silt	84	30	53.2	1.44	4.0	Albany	99	50	73.2	7.45	
Santa Barbara	79	43	58.4	0.27		Sugarloaf	72	22	45.0	1.58	6.0	Allapaha	97	53	72.5	5.97	
Santa Barbara L. H.	85	36	59.5	0.21		Trinidad	81	31	56.9	0.13		Alpharetta	90	43	66.9	4.92	
Santa Clara	85	36	59.5	0.00		Twinlakes	88	21	49.3	0.10	1.0	Americus	97	48	71.9	7.94	
Santa Clara College	92	36	59.5	0.00		Vilas	88	21	49.3	0.61		Athens	90	50	68.8	2.78	
Santa Cruz	95	33	56.6	0.00		Walter	79	28	52.6	1.03		Bainbridge	95	56	72.2	4.59	
Santa Cruz L. H.	85	33	56.6	0.00		Waterdale	79	28	52.6	0.65		Blakely	93	51	69.8	7.50	
Santa Maria	80	35	59.3	T.		Westcliffe	74	18	45.2	0.58		Bowersville	96	48	69.5	2.94	
Santa Monica	69	41	57.2	0.02		Whitepine	67	11	38.0	1.42	11.0	Butler	65				
Santa Rosa	92	34	59.0	T.		Wray	88	31	58.0	1.95		Camak	95	51	70.6	4.30	
Shasta	101	40	69.8	0.57		Yuma	88	21	49.3	1.00	T.	Carlton	92			2.09	
Sierra Madre	85	43	60.4	0.33		<i>Connecticut.</i>	92	33	60.6	0.49		Clayton	92	44	65.4	3.87	
Sisson	101	32	55.0	0.21		Bridgeport	92	33	60.6	0.49		Columbus	94	50	71.6	11.95	
Sonoma	85	36	59.5	0.00		Canton	88	24	56.3	0.81		Coney	99	46	72.8	4.70	
S. E. Farallone L. H.	85	36	59.5	0.00		Colchester	89	31	59.0	0.42		Covington	92	44	68.9	4.11	
Stockton	95	43	64.3	0.08		Falls Village	90	32	58.7	0.95		Dahlonega	90	44	66.0	4.02	
Storey	102	36	66.1	0.00		Hartford	90	32	58.7	0.95		Dawson	98	46	72.2	8.10	
Summerdale	82	23	52.5	0.79		Hawleyville	88	29	59.6	1.61		Diamond	90	39	66.0	3.85	
Susanville	89	27	55.1	0.58		Lake Konomooc	90	30	59.0	0.65		Douglas	103	55	73.2	6.74	
Tehama ¹	100	52	73.2	0.69		New London	90	34	50.0	0.54		Dublin	92			5.62	
Tejon Ranch	95	42	66.6	T.		North Grosvenor Dale	91	29	58.2	0.49		Dudley	96	56	71.6	5.71	
Trinidad L. H.	72	34	49.3	0.53		Norwalk	95	29	61.2	0.07		Eastman	101	54	73.9	7.44	
Truckee ¹	72	34	49.3	0.53		Southington	90	28	59.2	0.50		Eatonton	92	49	69.8	5.24	
Tulare ^c	102	38	67.5	T.		South Manchester	88	28	60.6	0.50		Elberton	98	50	70.9	2.12	
Tustin	83	56	67.7	0.00		Storrs	89	30	58.2	0.46		Experiment	91	44	68.4	6.47	
Ukiah	102	34	61.8	T.		Voluntown	93	30	58.2	1.23		Fitzgerald	99	55	72.2	4.84	
Upland	90	39	59.4	0.63		Wallingford	93	31	61.4	0.73		Fleming	99			7.24	
Upperlake	97	33	61.0	0.08		Waterbury	93	31	61.4	0.73		Forsyth	95	48 ^a	70.6	6.26	
Upper Mattole ¹	83	37	52.8	0.74		West Cornwall	89	26	58.2	1.39		Fort Gaines	95	50	71.7	8.67	
Vacaville ¹	103	48	66.1	T.		West Simsbury	91			0.73		Gainesville	91	46	67.5	4.79	
Ventura	72	40	56.6	0.00		<i>Delaware.</i>	91	37	64.6	2.51		Gillsville	94	47	69.2	2.60	
Visalia	103	39	67.4	T.		Delaware City	95	36	65.2	2.31		Greensboro	95	46	70.3	2.37	
Volcano Springs ¹	111	46	78.5	0.00		Milford	93	37	63.6	2.01		Griffin	91	46	68.6	4.81	
Wasco	102	35	69.2	0.00		Millsboro	93	31	63.0	2.18		Harrison	95	51	71.2	5.44	
Wheatland	97	42	65.4	0.07		Newark	90	31	63.0	2.18		Hawkinsville	98	46	71.2	7.17	
Williams ¹	98	52	74.0	0.00		Seaford	91	37	64.6	2.51		Hephzibah	98			4.85	
Willits	98	34	59.0	T.		<i>District of Columbia.</i>	86	45	66.3	2.67		Jesup	101	53	73.1	7.96	
Willow	98	41	66.8	0.03		Distributing Reservoir ¹	86	46	65.5	2.11		Lost Mountain	93	42	69.8	4.27	
Yerba Buena L. H.	88	32	56.4	0.43		Receiving Reservoir ¹	86	43	66.5	2.11		Louisville	95	50	70.7	10.10	
Zenia	88	32	56.4	0.43		West Washington	93	34	64.9	3.41		Lumpkin	94	53	71.4	11.67	
<i>Colorado.</i>						<i>Florida.</i>	97	58	74.4	5.66		Marshallville	96 ¹	52 ¹	71.4 ¹	4.82	
Alford	76	26	49.2	0.36		Archer	94	57	74.4	1.98		Mauzy ^d	97	52	72.8	5.05	
Ashcroft	79	18	40.4	1.65		Bartow	93	56	76.0	6.21		Milledgeville	93	45	69.6	5.32	
Blaine	93	26	58.4	0.82		Bonifay	93	56	73.1	6.03		Millen	101	50	73.1	5.49	
Boulder	79	30	54.5	0.2		Carrabelle	89	58	72.5	4.65		Monticello	96	47	70.6	2.84	
Boxelder	66																

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Idaho—Cont'd.</i>						<i>Illinois—Cont'd.</i>						<i>Iowa—Cont'd.</i>					
Forney	84	19	47.2	2.05	16.0	Sycamore	90	28	63.2	3.16		Buckingham	85	31	65.2	7.57	
Garnet	93	33	60.2	0.34		Tilden	88	28	66.2	2.69		Burlington	85	31	65.2	4.83	
Grangeville	88	31	51.0	3.73	6.8	Tiskilwa	83	31	62.4	3.72		Carroll	85	29	59.8	9.54	
Idaho City	90 ^a	25	50.7 ^a	1.16	T.	Tuscola	88	26	65.6	2.07		Cedar Rapids	87	33	64.1	6.11	
Lake	76	18	45.7	1.30	3.0	Urbana	86	26	64.0	3.95		Chariton	83	28	61.4	7.75	
Lakeview	90	31	51.8	1.91	T.	Walnut	86	31	65.4	4.59		Charles City	83	31	60.5	9.15	
Lost River	82	21	47.0	0.78	1.0	Winchester	88	30	66.3	3.24		Chester	81	27	59.6	9.44	
Moscow	90	28	52.8	3.63	6.2	Winnebago	86	28	62.4	3.73		Clarinda	84	27	62.9	9.97	
Murray	91	25	47.4	2.96	T.	Yorkville	88	29	62.2	3.01		Clearlake	91	29	62.6	7.54	
Oakley	92	28	52.4	1.04		Zion	86	29	62.5	5.28		Clinton	91	28	64.2	5.45	
Ola	88	27	54.4	1.01		<i>Indiana.</i>						College Springs	82	28	62.8	9.10	
Pollock	96	34	56.8	1.31		Anderson	87	28	65.3	4.90		Columbus Junction	87	31	64.2	5.33	
Forthill	83	28	51.1	0.78		Angola	86	26	61.7	2.44		Corning	81	30	61.5	10.68	
Priest River	92 ^b	28 ^b	50.8 ^b	1.73		Auburn	90	26	62.0	3.04		Corydon	82	27	61.8	7.70	
Riddle	87	20	47.3	1.37	1.5	Bloomington	88	31	66.5	2.22		Council Bluffs	86	29	58.2	10.01	
St. Maries	88	30	53.0	2.57		Bluffton	88	24	62.6	1.89		Cumberland				8.27	
Silver City	84	23	47.0	1.04	2.0	Butterville	87	29	66.6	2.78		Decorah	87	32	61.4	6.75	
Soldier	84	20	47.4	0.32	T.	Elkhart	88	30	64.0	1.38		Delaware	83	28	60.6	4.77	
Vernon	84	21	47.3	3.02	9.5	Farmersburg	87	27 ^a	66.2	1.36		Denison	81	29	58.8	9.92	
Weston	87	27	51.2	2.45	1.7	Farmland	85	30	63.2	5.59		Desoto	82	31	62.5	8.38	
<i>Illinois.</i>						Fort Wayne	85	28	62.8	3.30		Dows	80	29	60.4	9.33	
Aledo	84	29	63.2	6.26		Franklin ^a	88	40	66.8	5.73		Earlham	81	24	60.0	11.60	
Alexander	87	28	65.4	3.42		Grenzestad	85	30	65.5	4.26		Elkader	88	30	62.1	5.89	
Antioch	85	33	61.0	3.65		Greensburg	87	26	65.7	4.28		Esterville	86	29	55.2	10.69	
Ashton	85	29	61.0	2.91		Hammond	87	31	60.2	3.21		Fayette	88	28	60.0	6.65	
Astoria	86	28	63.8	4.44		Hector	89	27	63.6	3.30		Forest City	82	30	59.6	10.17	
Aurora	86	27	61.8	3.11		Holland	90	29	67.3	0.88		Fort Dodge	82	31	60.0		
Beardstown						Huntington	88	24	63.4	2.86		Fort Madison				2.88	
Benton	91	30	69.2	2.53		Jeffersonville	91	34	68.8	2.42		Galva	80	27	60.2	10.07	
Bloomington	89	29	66.0	4.01		Kokomo	88	29	65.6	2.98		Gilmantown				8.24	
Bushnell	90	50 ^a	69.2 ^a	3.26		Lafayette	86	29	65.0	2.71		Grand Meadow	82	30	61.0	8.33	
Cambridge	86	30	64.0	7.03		Laporte	83	27	58.5	2.59		Greene	84	30	61.8	6.37	
Carlinville	89	28	66.0	3.17		Madison	93	30	68.5	2.08		Greenfield	80	28	60.7	13.50	
Carrollton ^a	88	31	66.3	2.33		Madison ^b						Grinnell	81	30	61.7	12.69	
Centralia	89	28	67.4	2.96		Marengo	90	29	67.0	1.94		Grundy Center	82	29	61.0	11.04	
Charleston	90	28	67.8	0.63		Marion	90	26	65.1	4.12		Guthrie Center	84	29	62.4	14.16	
Chester						Markle	87	26	63.1	3.40		Hampton	83	31	62.1	7.95	
Chicago Heights						Mauzy	87	27	64.4	4.29		Hanlontown	80	30	60.4	7.67	
Cline	90	29	67.8	3.37		Moores Hill	87	30	65.8	3.78		Harian	83	26	61.3	10.43	
Coatsburg	89	30	65.5	3.68		Mount Vernon	92	31	68.8	3.72		Hopeville	83	29	62.2	8.59	
Cobden	89	31	67.8	3.16		Northfield	87	25	63.1	7.75		Humboldt	89	30	61.8	7.50	
Danville	89	27	65.6	4.75		Paoli	90	29	67.0	3.07		Idagrove	81	31	61.2	8.40	
Decatur	87	26	65.6	3.66		Princeton	88	28	68.0	3.12		Independence	81	28	60.8	6.78	
Dixon	88	30	63.1	4.35		Rensselaer	86	29	63.7	2.69		Indianola	83	30	63.1	8.39	
Dwight	88	24	63.6	3.24		Richmond	88	26	64.4	4.78		Iowa City	90	29	63.8	6.90	
Equality	89	33	69.2	2.60		Rockville	85	28	65.6	4.95		Iowa Falls	82	28	60.6	7.17	
Fandon	86	29	63.8	2.85		Rome	93	31	68.4	1.74		Jefferson				14.29	
Flora	88 ^a	29 ^a	66.1 ^a	1.75		Terre Haute	90	31	67.8	3.20		Keosauqua	87	29	64.2	4.84	
Friendsgrove	86	31	67.2	5.37		Topeka	90	27	62.0	0.62		Lacona				11.35	
Galva	86	30	63.6	5.42		Valparaiso	87	27	62.8	2.43		Lansing	85	27	62.8	7.30	
Grafton						Vevay	90	32	67.6	2.70		Larchwood	86	28	59.6	8.33	
Greenville	90	30	67.4	1.71		Winamac ^a	86	24	62.4	1.75		Larabee ^a	84	30	59.6	10.52	
Griggsville	89	34	66.8	3.34		Indian Territory.						Leclaire				4.27	
Halfway	88	34	69.4	3.06		Ardmore	92	32	68.1	3.29		Lemars	80	31	59.2	9.89	
Halliday	89	29	68.2	1.67		Chickasha	89	27	67.5	4.27		Lenox	80	30	61.9	10.58	
Henry	86	29	64.4	3.85		Durant	100	33	69.8	3.59		Leon	84	29	63.3	7.25	
Hillsboro	90	29	66.6	2.83		Fairland	85	29	65.3	11.55		Logan	84	29	62.0	5.77	
Hooperston	88	28	65.1	3.77		Goodwater	85	30	66.2	9.53		Maple Valley				7.27	
Joliet	86	29	62.7	2.49		Hartshorne	87	29	65.1	7.03		Maquoketa	86	27	61.2	6.55	
Kishwaukee	87	27	61.4	3.73		Healdton	90	24	67.6	2.58		Marshalltown	85	29	62.5	8.46	
Knoxville	86	24	62.4	4.57		Holdenville	85	33	66.7	10.35		Mason City	82	32	61.6	7.57	
Lagrange	89	27	61.4	1.27		Marlow	86	32	66.0	3.34		Monticello	85	29	62.2	6.30	
Laharpe	86	29	63.7	3.00		Muskogee	85	32	66.1	9.92		Mountay	83	27	61.7	8.90	
Lanark	87	24	62.3	5.05		Pauls Valley	88	24	65.3	3.75		Mount Vernon	87	29	62.3	7.05	
Loami						Ravia	90	32	69.0	3.43		New Hampton	79	29	59.8	6.	

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	
<i>Iowa—Cont'd.</i>	°	°	°	In.	In.	<i>Kentucky—Cont'd.</i>	°	°	°	In.	In.	<i>Maine—Cont'd.</i>	°	°	°	In.	In.	
Willisca.	82	27	59.5	13.66		Berea.	92	33	2.02			Millinocket.	82	26	54.8	0.72		
Vinton ¹ .	83	32	62.4	5.30		Blandville.	87	33	4.43			North Bridgton.	92	25	56.2	0.54		
Wapello.	85	33	64.0	5.39		Bowling Green.	93	33	4.95			Orono.	83	23	54.4	0.73		
Washington.	86	27	62.0	5.12		Burnside.	90	37	6.71	2.83		Patten.	85	22	52.2	0.12		
Washta.				10.80		Cadiz.	94	34	4.94			Rumford Falls.	90	27	54.4	0.18		
Waterloo.	84	30	61.4	7.85		Catlettsburg.	89	33	6.6	1.58		South Lagrange ¹ .	85	33	54.7			
Waukee.				10.78		Earlington.	88	34	6.75	5.92		The Forks.			0.61			
Waverly.	82	30	61.0	6.66		Edmonton.	89	33	6.78	3.69		Vanburen.	88	18	57.5	1.56		
Westbend.	84	31	61.0	8.69		Eubank.	88	33	6.57	3.08		Vanceboro.	80	30	55.2	0.20		
Westbranch.				6.76		Falmouth.						Winslow.			0.31			
West Union.				8.28		Fords Ferry.	87	29	6.76	4.25		<i>Maryland.</i>						
Whitten.	82°	27°	62.0°	10.44		Frankfort.	89	35	6.66	1.03		Annapolis.	90			3.50		
Wilton Junction.	88	29	63.8	5.89		Franklin.	90	38	6.92	1.80		Bachmans Valley.	89	28	62.2	4.78		
Winterset.	85	27	64.0	9.20		Greensburg.	90	34	6.74	4.27		Boettcherville.	94	28	65.0	2.70		
Woodburn.				7.23		Highbridge.	90	35	6.79	1.01		Boonsboro.	92	33	65.0	2.49		
<i>Kansas.</i>						Hopkinsville.	88	33	6.78	6.18		Cambridge.	92	39	66.2	1.81		
Achilles.	87	30	56.7	3.94		Irvington.	91	34	69.7	1.14		Chase.	80			1.60		
Altos.	89	30	62.0	10.27		Jackson.	90	35	67.6	1.44		Cheltenham.	93	36	64.8	2.98		
Anthony.				8.42		Leitchfield.	88	35	68.0	4.65		Chestertown.	87	32	63.2	1.86		
Atchison.	88	31	64.7	11.80		Loretto.	89	31	67.1	2.80		Chewsville.	90	31	62.0	4.28		
Baker.	84	30	62.8	12.48		Manchester.	93	34	67.6	2.15		Clearspring.	91	34	63.4	2.00		
Beloit.	84	30	60.6	9.20		Marrowbone.	94 ^a	32 ^a	68.74	4.20		Coleman.	92	35	65.6	1.20		
Burlington.	85	28	64.1	7.66		Mayfield.	86	34	68.1	2.07		Collegepark.	91	31	62.0	3.10		
Chanute.	86	30	63.5	9.93		Maysville.	93	32	67.8	2.41		Colora.			2.99			
Clay Center.	86	28	62.8	13.36		Middlesboro.	91	35	66.0	4.11		Cumberland.			1.92			
Colby.	86	32	57.2	3.00		Mount Sterling.	91	33	68.4	1.51		Darlington.	97	32	64.4	3.38		
Columbus.	85	29	64.2	14.47		Owensboro.	87	36	68.8	2.50		Dearpark.	88 ^a	24 ^a	57.8 ^a	4.35		
Cottonwood.	85	28	63.4	9.15		Owenton.	87	34	65.9	3.00		Denton.		34		0.35		
Dresden.	86	33	58.0	4.79		Paducah ^a .						Easton.	93	34	64.3	1.68		
Ellinwood.	88	30	62.6	6.49		Paducah ^b .	93	35	71.0	3.92		Falston.	91	32	63.2	2.13		
Emporia.	85	31	62.4	8.96		Princeton.	89	32	68.2	5.69		Frederick.	91	30	64.2	2.65		
Englewood.	88	30	63.2	6.35		Richmond.	94	36	70.6	3.32		Grantsville.	87	25	58.8	2.79		
Eureka.				10.37		St. John.	87	33	67.2	3.86		Greatfalls.	94 ^a	28 ^a	63.4 ^a	1.89		
Eureka Ranch.	87	31	59.6	5.98		Scott.	88	31	66.4	3.87		Greenspring Furnace.	94	35	64.8	1.18		
Fall River.	84	28	63.8	11.62		Shelby City.	88	32	66.2	2.61		Hancock.	95 ^a	28 ^a	64.7 ^a	1.90		
Farnsworth.	88	30	59.7	2.32		Shelbyville.	94	35	69.1	0.92		Harney.			3.81			
Forsha.	87	30	61.5	5.53		Taylorville.	91	33	67.2	0.52		Jewell.	92	39	64.5	2.34		
Fort Leavenworth.	85	31	64.5	10.50		Williamsburg.	90	35	67.1	2.78		Johns Hopkins Hospital.	92	36	66.0	3.42		
Fort Scott.	87	29	64.0	7.84		Williamstown.	88	32	66.2	3.18		Laurel.	95	34	64.0	2.62		
Frankfort.	87	27	63.2	16.34		<i>Louisiana.</i>						McDonogh.	90	39	63.8	2.74		
Garden City.	92	35	60.8	1.49		Abbeville.	93	46	73.2	2.00		Mount St. Marys College.	90	34	64.0	3.86		
Grenola.	83	24	62.2	14.33		Alexandria.	93	43	72.2	1.07		New Market.	90	31	64.0	2.75		
Hanover.	87	29	62.6	14.25		Amitie.	91	47	72.4	3.14		Pocomoke City.	91	38	65.4	0.98		
Hays.	88	25	59.6	10.08		Baton Rouge.	90	46	72.2	2.53		Prince Fredericktown.	92	39	65.5	4.12		
Holton.				13.09		Burnside.	88	46	72.2	2.28		Princess Anne.	90	35	62.8	1.25		
Horton.	84	30	63.2	13.32		Calhoun.	91	40	70.1	3.90		Sharpsburg.	90	34	64.4	3.10		
Hoxie.	89	30	59.0	3.10		Cameron.	85	51	73.6	2.50		Solomons.	93	41	65.6	2.81		
Hutchinson.	87	27	61.7	7.51		Cheneyville.	91	48	72.1	2.08		Sudlersville.	94	34	64.9	1.41		
Independence.	87	31	65.8	9.73		Clinton.	89	45	71.4	2.75		Sunnyside.	93	25	62.3	4.50		
Jetmore.	89	34	61.2	3.66		Collinston.	90	38	70.9	4.21		Takoma Park.	93	35	64.1	2.09	T.	
La Crosse.	87	28	60.2	5.66		Covington.	91	48	73.4	1.66		Tibbetts.	90	34	64.2	3.18		
Lakin.	89	35	60.9	2.54		Donaldsonville.	89	48	72.8	3.58		Westernport.	90	29	63.4	2.93		
Lebanon.	84	30	60.5	10.70		Emilie.	88	48	72.5	0.93		Woodstock.	90	33	64.4	2.61		
Lebo.	85	31	64.0	8.59		Farmerville.	86	38	69.5	4.11		<i>Massachusetts.</i>						
Leoti.	89	29	58.8	4.71		Franklin.	92	47	74.0	1.57		Amherst.	92	24	59.8	0.48		
Macksville.	88	28	60.2	6.65		Grand Coteau.	91	47	72.9	3.03		Bedford.	86	28	58.2	0.63		
McPherson.	89	27	62.3	10.85		Hammond.	91	47	72.0	1.47		Bluehill (summit).	89	29	58.0	1.28		
Madison.	84	20	62.9	9.27		Houma.	92	45	72.8	1.99		Cambridge.	90	29	59.7	0.38		
Manhattan.	89	28	65.2	9.60		Jennings.	88 ^a	49 ^a	69.6 ^a	5.14		Chestnut Hill.	91	30	59.4	0.79		
Marion.	89 ^a	26 ^a	64.4 ^a	7.83		Lafayette.	89	47	73.0	3.30		Cohasset.			0.76			
Meade.	88 ^b	33 ^b	60.4 ^b	3.45		Lake Charles.	88 ^a	46	71.6 ^a	2.59		Concord.	91	26	57.0	0.76		
Medicine Lodge.	90	31	64.2	6.86		Lake Providence.	90	48	70.2	4.15		East Templeton ¹ .	87	33	58.0	1.36		
Minneapolis.	88	29	61.7	9.39		Lakeside.	86	48	72.4	2.23		Fall River.	87	33	59.1	1.08		
Moran.	83	30	64.1	6.9														

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Michigan—Cont'd.</i>						<i>Michigan—Cont'd.</i>						<i>Michigan—Cont'd.</i>					
Baldwin	89	15	58.4	2.43	Ins.	Whitecloud	88	17	57.4	1.72	Ins.	McNeill	92	48	71.6	1.36	Ins.
Ball Mountain	84	25	57.8	3.56		Whitefish Point	69	21	46.9	3.51	T.	Macon	96	40	71.8	5.81	
Baraga	88	14	48.6			Ypsilanti	86	23	58.6	2.07		Magnolia	90	45	71.0	4.13	
Battlecreek	86	25	60.4	2.39		<i>Minnesota.</i>						Nittayuma	92	40	72.4	1.95	
Bay City	85	24	57.8	1.95		Ada	84	27	55.5°	2.67		Okolona	95	40	72.2	5.40	
Benzonia	83	26	54.6	2.13	T.	Albert Lea	81	30	59.8	7.99		Patmos				3.39	
Berlin	86	24	57.4	4.18		Alexandria	79	31	56.3	2.75		Pearlington	89	50	71.8	2.15	
Berrien Springs	88	27	62.2	2.05	T.	Angus	85	19	55.0	2.40		Pittsboro	92	36	69.8	3.17	
Big Rapids	86	20	56.9	3.01		Ashby	78	26	56.6	4.75		Pontotoc	87	37	69.6	4.14	
Birmingham	87	26	59.1	2.09		Beardsley	83	28	56.6	3.20		Poplarville	90	47	72.0	1.84	
Boon	83	15	54.0	2.73	T.	Beaupre	83	23	54.8	3.32		Ripley	90	35	68.4	6.31	
Calumet	81	25	51.5	5.77	3.0	Bemidji	81	24	56.8	3.01		Shoecoe	91	43	70.7	2.51	
Cassopolis	89	30	63.8	0.60		Bird Island	81	27	56.8	4.67		Stonington				4.78	
Charlevoix	81	27	55.2	1.55		Blooming Prairie	80	30	58.6	10.00		Suffolk	91	42	70.3	3.41	
Chatham	82	12	51.6	4.12	T.	Caledonia	85	29	58.8	9.43		Swartwout	87	51	70.6	5.93	
Cheboygan	83	22	52.6	2.33		Campbell	83	23	56.6	2.49		Thornton	88	46	71.4	1.95	
Clinton	92	25	61.8	2.49		Collegeville	79	30	57.4	4.02		Tupelo	92	38	70.0	5.64	
Coldwater	88	26	62.9	1.17		Crookston	85	24	54.9	3.74		University	90	36	70.3	3.60	
Deerpark	84	24	49.2	3.45		Deephaven						Walnutgrove	92	40	71.0°	2.05	
Detour	78	21	50.5	2.31		Detroit	80	22	54.4	3.77		Watervalley	91	37	69.0	4.47	
Dundee	87	28	60.6	0.94		Duluth (sub station)	76	26	47.6	3.59		Waynesboro	90	46	69.6	1.65	
Eagle Harbor	84	20	47.7	5.44	2.0	Faribault	80	29	58.2	7.74		Westpoint	92	38	71.6	7.96	
East Tawas	80	22	51.8	1.83		Farmington	80	32	58.2	6.39		Woodsville	90	43	71.6	3.30	
Eloise	89	25	60.4	1.79		Fergus Falls	81	26	57.5	2.45		Yazoo City	91	42	72.0	1.55	
Ewen	85	20	52.9	5.94		Floodwood	79	11	53.8	3.90		<i>Missouri.</i>					
Fenville	85	24	61.0	2.23		Glencoe	80	32	58.3	4.30		Arthur	85	28	63.4	9.68	
Fitchburg	86	22	58.8	2.82		Grand Meadow	84	23	59.4	9.42		Avalon	86	30	66.2	3.36	
Flint	89	24	58.0	3.93		Halloch	86	21	54.6	2.30		Bethany	84	27	63.2	8.19	
Frankfort	84	34	57.1	2.86		Lake Winnibigoshish	78	22	54.2	4.00		Birchtree	84	33	65.8	8.49	
Gaylord	84	16	54.0	1.00		Leech	83	18	53.9	4.35		Blue Springs	84	28	62.4	7.05	
Gladwin	86	21	56.8	2.40		Long Prairie	81	22	56.6	3.30		Boonville				5.24	
Grand Marais	79	31	49.8	2.87		Luverne	78	30	56.7	8.20		Brunswick	85	31	64.6	5.97	
Grand Rapids	87	21	50.5	2.28		Lynd	81	32	57.3	6.40		Carrollton	83 ^a	29 ^a	64.0 ^a	9.91	
Grape	90 ^b	26	59.7 ^b	1.59		Mapleplain	83	30	58.0	4.89		Caruthersville	91	40	69.6	5.49	
Grayling	87	21	57.2	3.60	T.	Milaca	80	21	55.6	4.53		Conception	84	31	63.5	8.67	
Hagar	88	28	63.1	1.59		Milan	82	30	57.8	3.97		Cowgill				5.14	
Hanover	89	23	59.6	2.30		Minneapolis ^a	83	30	58.4	4.96		Darksville	83	31	64.1	3.80	
Harbor Beach	86	24	53.6	3.55		Montevideo	82	32	57.4	4.66		Dean	84	25	64.2	9.87	
Harrison	75	20	51.9	2.20		Morris	80	29	57.6	3.84		Desoto	87	27	65.2	4.19	
Harrisville	85	32	52.4	2.95		Mount Iron	83	33	53.5	3.87		Downing				8.08	
Hart	89	20	50.4	2.05		New London	80	30	57.2	3.48		Edgewell	86	28	65.6	6.42	
Hastings	90	20	60.4	2.47		New Richland	80	31	59.3	5.98		Edwards	86	27	65.6	6.50	
Hayes	86 ^b	28 ^b	56.6 ^b	1.89		New Ulm	84	26	60.8	6.22		Eightmile ^a	85	28	64.0 ^a	7.92	
Highland Station						Park Rapids	80	22	54.4	3.99		Eldon	88 ^a	28 ^a	64.6 ^a	5.23	
Hillsdale	88	21	60.2	3.23		Pine River	81	15	54.6	4.42		Fairport				9.11	
Humboldt	83	20	49.9	2.33	T.	Pipestone	78	32	57.0	6.77		Fayette	86	30	65.4	5.18	
Ionia	85 ^b	22 ^b	59.2 ^b	2.00		Pleasant Mounds	80	31	59.0	6.20		Fulton	89	27	65.4	5.01	
Iron Mountain	84	20	54.0	6.63		Pokegama Falls	82	14	53.6	4.43		Gallatin ^a	84	32	64.3	10.36	
Iron River	83	10	52.6	6.45		Redwing a						Glasgow	86	30	65.0	3.65	
Ironwood	82	18	52.8	4.77	T.	Redwing b	80	30	59.6	7.88		Gorin				5.94	
Ishpeming	84	17	52.2	8.71		Reeds						Grant City	81	29	62.6	7.58	
Ivan	85	17	55.9	1.53		Rolling Green	82	27	58.8	10.17		Halfway	84	29	64.2	5.18	
Jackson	90	25	62.1	3.56		St. Cloud	81	30	59.0	5.46		Harrisonville	86	28	64.1	9.24	
Jeddo	86	24	57.2	3.75		Sandy Lake Dam	79	18	55.1	3.69		Hazlehurst				7.53	
Kalamazoo	84 ^b	25	60.6 ^b	2.50		Shakopee	81	31	58.8	5.67		Hermann				5.15	
Lake City	73	35	58.1	1.83		Thief River Falls	83	24	55.2	4.25		Houston	88	27	66.0	8.61	
Lansing	82	30	60.4	2.07		Tower	83	20	52.1	3.80		Huntsville	85	31	64.8	4.18	
Lapeer	87	23	58.2	2.64		Two Harbors	71	27	46.1	4.03		Ironton	89	26	66.1	4.44	
Lincoln	84	21	58.8	2.48		Wabasha	86	29	62.0	8.76		Jackson	88	29	66.9	4.70	
Ludington	81	27 ^b	55.0	0.84		Warroad	80	24	53.7			Jefferson City	90	28	65.9	5.27	
Mackinac Island	77	24	50.9	2.91		Willow River	85	19	54.5	4.02		Joplin	84	32	65.9	11.64	
Mackinaw	78	26	51.8	2.75		Winnebago	86	32	60.4	7.99		Kidder	83	31	63.2	8.64	
Mancelona	84	26	58.6	0.50		Winona	84	31	60.7	9.55		Koshkonong	84	32	65.2	8.69	
Manistee	83	34	58.8			Worthington	77	29	56.6	12.68		Lamar	85	29	65.4	13.32	
Manistique	72	20	48.6	3.14		Zumbrota	84	30	59.2								

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.			Stations.	Temperature. (Fahrenheit.)			Precipita- tion.			Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Ins.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Ins.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.	Ins.
<i>Missouri—Cont'd.</i>	°	°	°	Ins.	Ins.		<i>Nebraska—Cont'd.</i>	°	°	°	Ins.	Ins.		<i>Nebraska—Cont'd.</i>	°	°	°	Ins.	Ins.	
Sedalia	89	30 ^a	65.4	4.80	7.82		David City	80	30	59.8	13.09			Wilber *1	86	34	64.0	11.25		
Seymour	83	28	63.4	9.78			Dawson	84	30	63.3	11.61			Willard	—	—	—	2.63		
Shelbyville	—	—	—	—	—		Edgar	—	—	—	—	—		Wilsonville	—	—	—	11.60		
Sikeston	84	31	67.3	4.29			Ewing	—	—	—	—	—		Winnebago	83	27	60.5	10.90		
Steffenville	85	31	64.9	7.48			Fairbury	88	29	60.3	13.27			Wisner	—	—	—	9.81		
Sublett	84	27	63.4	6.35			Fairmont	81	23	58.8	12.37			Wymore	88	35	63.6	14.29		
Trenton	84	32	64.3	10.24			Fort Robinson	84	16	52.2	2.29			York	82*	32*	59.0*	16.40		
Unionville	84	29	64.2	5.78			Franklin	84 ^b	27 ^b	59.1 ^b	9.98			<i>Nevada.</i>	—	—	—	—		
Vichy	88	25	64.8	6.21			Fremont	83	29	61.0	10.94			Austin	82	26	50.8	1.57		
Warrensburg	90	31	65.5	8.75			Geneva	86	33	59.7	13.78			Battle Mountain	94	28	56.0	0.40		
Warrenton	90	30	66.4	5.07			Genoa (near)	80	33	60.0	7.51			Belmont	79	19	50.0	0.78	1.0	
Wheatland	—	—	—	7.00			Gering	83*	26	54.2	1.71			Beowawe	96	38	61.8	0.55		
Willow Springs	85	24	64.4	11.80			Gordon	—	—	—	—			Caliente	96	29	61.7	0.55		
Windsor	83	29	64.2	4.85			Gosper	—	—	—	—			Candelaria	82	30	56.8	0.66	T.	
Zeitonia	90	29	66.6	4.29			Gothenburg	86 ^c	32 ^c	56.6 ^c	3.93			Carlin *1	82	26	49.4	0.00		
<i>Montana.</i>	—	—	—	—	—		Grand Island a	—	—	—	—			Carson City	88	28	53.6	0.14	T.	
Adel	80	22	44.9	1.85	7.5		Grand Island b	82	31	58.8	12.47			Cranes Ranch	—	—	—	0.99		
Augusta	84	24	47.2	2.48	8.0		Greeley	—	—	6.45	—			Dyer	87	20	54.8	0.30		
Billings	90 ^a	22 ^a	48.2 ^a	—	—		Guide Rock	—	—	13.75	—			Elko	85	26	52.2	1.20	T.	
Boulder	83	22	45.8	1.70	8.5		Haigler	—	—	2.98	—			Ely	82	25	49.4	2.18	5.0	
Bozeman	82	21	47.1	2.58			Halsey	91	31	58.0	5.19			Eureka	85	25	51.2	1.10	14.5	
Butte	81	21	45.8	1.20			Hartington	85	19	59.1	8.14			Fenelon	—	—	—	0.70	7.0	
Chester	90	20	53.8	0.44	4.0		Harvard	83	30	59.2	9.72			Golconda *1	95	35	57.2	0.00		
Canyon Ferry	87	27	50.4	0.93	2.0		Hastings *1	82	35	59.0	10.92			Halleck *1	95	36	53.8	—		
Chinook	95	29	52.4	3.40			Hayes Center	—	—	5.48	—			Hamilton	50	20	36.0	2.92	29.2	
Columbia Falls	90	25	46.8 ^a	3.99	0.2		Hay Spring	83	28	51.0	3.91			Hawthorne	90	31	57.1	0.00		
Culbertson	98	21	52.4	4.04	T.		Hebron	84	31	60.4	14.01			Humboldt	90	33	56.6	0.20		
Crow Agency	90	29	54.7	1.50			Hickman	—	—	11.94	—			Lee	—	—	—	2.79	6.0	
Dayton	87	28	48.2	1.21	T.		Holbrook	—	—	6.31	—			Lovelock	92	38	59.4	0.00		
Deerlodge	83	25	46.3	—	—		Holdrege	—	—	12.36	—			Martins	92	28	55.8	T.	T.	
Dillon	84	24	48.4	2.12	17.0		Hooper *1	84	38	61.8	14.09			Mill City *1	94	34	52.0	0.00		
Fort Benton	90	28	50.0	3.23	6.5		Imperial	87	32	58.0	3.17			Morey	87	20	51.6	1.47	3.0	
Glasgow	98	22 ^b	55.1 ^b	5.35	T.		Johnstown	—	—	2.65	—			Palisade	86	28	52.2	0.87	3.5	
Glendive	95	30	51.8	1.29			Kearney	83	—	8.64	—			Palmetto	82	19	51.0	1.20	12.0	
Great Falls	89	27	51.0	1.84			Kennedy	86	30	57.2	4.48			Potts	85	15	48.0	1.90	4.7	
Hamilton	90	18	51.7	0.70			Kimball	81	28	52.8	1.56			Reno State University	87	30	54.0	0.14	1.1	
Hayden	93	27	50.6	0.33			Kirkwood	84	32	59.6	6.66			Riverville	106	45	75.5	T.		
Lamedeer	92	22	52.7	0.76			Leavitt	84	32	62.8	15.51			Silverpeak	92 ^b	22 ^b	57.8 ^b	T.		
Lewistown	88	20	47.6	4.70	23.0		Lexington	80	29	56.7	5.80			Sodaville	95	29	59.6	0.49		
Livingston	85	10	43.6	2.25			Lockridge	82	32	59.4	13.55			Tecoma	88	23	52.2	1.75		
Manhattan	88	24	50.2	0.86			Lodgepole	85	28	55.0	—			Toano *1	97	24	52.6	0.89	T.	
Marysville	79 ^b	19 ^b	44.0 ^b	2.72	22.5		Loup	80	30	58.4	9.79			Wabuska	92	24	55.0	0.20	T.	
Missoula	89	31	51.8	1.50	T.		Lynch	81	—	7.25	—			Wadsworth	95	33	58.4	0.07	T.	
Ovando	86	23	45.2	0.80			Lyons	—	—	10.67	—			Wells *1	62	22	41.2	T.		
Parrot	84	25	48.8	0.90	4.6		McCook	—	—	6.87	—			Wood	85	25	50.6	1.07		
Plains	87	29	49.1	0.80			McCool Junction	—	—	12.93	—			<i>New Hampshire.</i>	—	—	—	—	—	—
Poplar	97	24	53.0	2.65			Madison	80	34	59.4	8.87			Alstead	85	23	57.6	1.33		
Red Lodge	81	21	45.8	2.04	6.7		Madrid	90*	28*	56.8*	3.82			Berlin Mills	89	13	55.2	0.19		
Ridgeway	96	20	53.4	4.64	T.		Marquette	—	—	10.65	—			Bethlehem	85	20	56.2	0.29		
St. Pauls	89	25	49.1	4.03	22.0		Mason	—	—	5.40	—			Brookline *1	92	27	62.5	1.28		
St. Peter	83	23	45.0	4.05	37.0		Minden b	81	32	58.1	9.57			Chatham	87	18	54.8	0.55		
Springbrook	95	20	51.8	1.93	1.0		Monroe	—	—	8.15	—			Concord	89	22	57.0	0.55		
Summit	79	14	42.7	4.77	4.5		Nebraska City c	84	29	63.4	11.03			Durham	90	25	56.2	1.07		
Toston	87	17	43.8	—	—		Nemaha	—	—	12.22	—			Franklin Falls	90	24	57.8	0.50		
Townsend	—	—	—	0.65	—		North Loup	83	30	58.8	6.22			Grafton	88	14	55.2	0.56		
Twin Bridges	84 ^a	24 ^a	47.8 ^a	0.40	2.0		Oakdale	83	32	59.2	9.58			Hanover	89	20	57.6	0.84		
Twodot	84	15	45.4	1.80	18.0		Odell	—	—	16.49	—			Keene	90	21	57.8	0.79	T.	
Utica	89	26	48.6	1.82	4.0		O'Neill	83	30	58.2										

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>New Jersey</i> —Cont'd.	9	9	9	Inz.	Inz.	<i>New York</i> —Cont'd.	9	9	9	Inz.	Inz.	<i>North Carolina</i> —Cont'd.	9	9	9	Inz.	Inz.
Perth Amboy	95	38	65.6	T.		Homer	89	19	56.4	0.28	T.	Monroe	99	44	69.5	0.59	
Phillipsburg	93	30	63.9	0.83		Honeymead Brook	91	27	59.5	1.20	T.	Morganton	97	41	67.1	0.61	
Plainfield	93	31	62.4	0.84		Indian Lake	86	12	52.8	0.21	T.	Mountairy	95	42	66.3	1.31	
Rancocas						Ithaca	86	22	57.6	0.30	T.	Murphy				2.60	
Ringwood	94 ^b	26 ^b	61.3 ^b	0.39		Jamestown	87	22	59.8	2.37	T.	Newbern	92	47	69.2	2.68	
Riverdale	94	30	61.6	0.60		Keene Valley	89	16	55.7	0.02	T.	Patterson ^a	93	40	62.1	1.87	
Salem	95 ^c	31 ^c	64.5 ^c	1.06		King Ferry						Penelo	95	48	68.0	2.39	
Somerville	95	31	62.3	1.25		Liberty	84	25	58.2	0.44	T.	Pittsboro	99	42	69.1	1.69	
South Orange	91	34	61.8	0.52		Littlefalls, City Res.	87 ^a	27 ^a	62.4 ^a	0.06	T.	Reidsville	95	41	67.0	1.86	
Sussex	93	28	61.6	0.70		Lockport	86 ^a	29	59.2 ^a	1.52		Rockingham	98	50	70.9	0.44	
Toms River	96	32	61.1	0.39		Lowville	85	20	55.8	0.67		Roxboro	94	38	66.7	3.59	
Trenton	92	36	66.4	0.30		Lyndonville						Salem	100	48	69.6	2.17	
Tuckerton	94	33	61.8	0.76		Lyons	91 ^c	29 ^c	60.6 ^c	0.15	T.	Salisbury	96	42	66.8	1.85	
Vineland	95	33	63.6	0.62		Middletown	90	31	61.3	0.34		Saxon	97	44	68.8	2.67	
Woodbine	93	32	61.1	1.00		Mohonk Lake	86	27	59.6	0.88		Selma	98	48	69.4	1.03	
Woodstown						Moira	88	20	57.5	0.05	T.	Settle	93	46	69.2	2.62	
<i>New Mexico</i>						Mount Ettrick	85	22	58.2	0.31	T.	Sloan	95	42	66.7	0.73	
Alamogordo	98	36	67.9	0.48		Newark Valley						Soapstone Mount	97	45	70.5	0.86	
Albert	89	37	63.3	0.27		New Lisbon	85	16	54.5	0.25		Southern Pines a	97	47	70.2	1.77	
Albuquerque	86	36	62.4	0.18		North Hammond	86	30	61.0	0.16		Southern Pines b	97	48	70.5	2.66	
Arabella	84	28	61.6	0.40		North Lake						Southport	99	45	68.3	0.95	
Bellranch						Number Four	81	21	56.8	0.45		Springhope	96	43	66.3	0.63	
Canbray						Nunda	90	22 ^a	59.2 ^a	0.56		Statesville	98	43	70.6	2.43	
Carlshad	99 ^c	40 ^c	70.6 ^c	T.		Ogdensburg	86	24	58.2	0.17		Tarboro	97	46	71.2	4.71	
Deming						Old Chatham						Washington	98	35	63.7	1.90	
Dorse	83	24	53.3	0.29		Oneonta	91	20	59.1	0.36		Waynesville	92	43	67.3	2.58	
Eagle Rock Ranch	80	29	53.6	1.55	T.	Otto	89	26	60.2	2.78		Weldon a	92	43	67.3	2.83	
Engle	84	37	63.0	0.77		Oxford	87	18	57.3	0.42		<i>North Dakota</i>					
Fort Bayard	88	34	61.3	0.17		Oyster Bay	95	30	61.6	0.40		Amenia	85	24	55.3	3.36	
Fort Stanton	79	23	55.1	0.38		Penn Yan	88	25	59.7	0.30		Ashley	85	22	53.8	1.74	
Fort Union	78	23	52.7	1.05		Perry City	88	18	57.2	0.72		Berlin	83	22	53.8	1.90	
Fort Wingate	78	21	49.8	1.05	1.0	Plattsburg	91	27	54.8	0.00		Bottineau	87	19	51.5	4.02	
Fruitland	92	31	59.6	0.03		Port Jervis	91	26	61.0	1.00		Buxton	84	22	55.4	2.93	
Gage						Potsdam	87	21	57.2	0.18		Cando	81	19	52.0	3.82	
Hot Springs	76	30	54.4	0.17		Primrose	95	30	61.0	0.78		Church Ferry	84	24	53.7	2.17	
Las Vegas	82	29	55.4	0.22		Redhook						Devils Lake	83	24	54.8	4.06	
Lordsburg						Richmondville	88	20	58.8	0.22		Dickinson	92	18	54.2	3.59	
Los Lunas	87	42	64.0	0.40		Ridgeway	85	28	58.2	1.14		Donnybrook				6.52	
Luna	85	20	52.6	1.03		Rome	88	24	61.0	0.03		Dunseith	82	21	51.6	5.81	
Mesilla Park	90	35	65.2	0.10		Speer Falls	89	24	60.0	0.44		Edgeley	86	27	55.6	2.24	
Mountaintair	81	30	55.6	0.06		Straits Corners	88 ^a	18 ^a	56.0 ^a	0.17		Elbowoods	87	23	52.7	2.50	
Raton	99	18	57.7	0.02		Ticonderoga	87	24	60.0	0.52		Ellendale	85	25	57.0	2.03	
San Marcial	97	37	67.1	T.	Volusia	80	26	57.9	1.47		Fargo	89	23	55.7	2.78		
Strauss					Walton	88	18	56.2	0.40		Forman	86	26	57.2	2.95		
Taos	81	26	54.4	T.	Wappinger Falls	91	29	61.0	5.92		Fort Yates	88	25	57.4	1.33		
Winsor	72	21	45.2	0.98		Warwick						Fullerton	84	23	55.0	2.06	
<i>New York</i>						Watertown	84	26	58.8	0.49		Gallatin	81	18	52.4	1.85	
Adams						Waverly	91	20	59.9	0.76		Glenullin	87	26	54.5	3.79	
Addison	90	21	58.6	1.90		Wedgewood	87	23	56.6	0.87		Grafton	85	24	56.1	1.53	
Adirondack Lodge	80	17	53.3	0.35	3.0	Wells	89	17	55.8	0.09		Jamestown	90	30	56.6	2.24	
Akron						West Berne	87	20	55.7	0.22		LaMoure				1.40	
Alden	83	29	59.6	1.51	T.	Westfield e	85	29	57.8	1.61		Langdon	81	19	52.0	3.02	
Amsterdam						Windham	85	20	56.4	0.92		Larimore	85	17	53.1	1.75	
Angelica	88	18	57.4	1.16	T.	Youngstown						Lisbon	86	24	56.0	4.38	
Appleton	87	28	56.2	1.45		<i>North Carolina</i>						McKinney	90	20	50.8	4.68	
Arcade	84	20	54.8	1.63	T.	Brevard						Mayville	86	11	50.8	1.17	
Athens	90	28	61.6	0.50	T.	Brewers	99	41	66.1	1.70		Medora	96	15	55.0	1.07	
Atlanta	87	18	56.6	1.16		Bryson City	99	41	66.1	1.92		Melville	87	25	56.0	2.40	
Auburn	91	25	60.6	0.74	T.	Chapelhill	96	44	69.0	1.18		Minnewaukon	94	25	55.0	2.08	
Avon	87	21	57.9	0.45	T.	Currituck						Minot	92	28	55.7	5.56	
Axon	87 ^a	15 ^a	52.2 ^a	0.15	T.	Edenton	95	46	68.4	4.13		Minto	86 ^a	19 ^a	52.8 ^a	1.53	
Baldwinsville	87	26	60.2	0.50		Fayetteville	95	48	58.9	2.55		Napoleon	96	20	55.4	2.41	
Beaver	86	14	54.8	0.05		Flatrock	92	36	63.8	2.79		New England	88 ^a	12 ^a	49.2 ^a	3.92	T.
Bedford						Goldsboro	93	47	69.3	0.96		Oakdale	91	32	54.3	7.83	
Berlin	88	20	57.8	0.58		Graham						Pembina	87	20	53.7	3.42	
Blue Mountain Lake						Greensboro	93	42	67.2	1.32		Portal	89	23	49.2	4.77	
Boilivar	86	18	56.0	2.43	T.	Henderson	93	40	67.5	1.50		Power					

TABLE II.—*Climatological record of voluntary and other cooperating observers—Continued.*

Stations.	Temperature. (Fahrenheit.)				Precipita- tion.	Stations.	Temperature. (Fahrenheit.)				Stations.	Temperature. (Fahrenheit.)				Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.			Maximum.	Minimum.	Mean.	Rain and melted snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.		
<i>Ohio—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>Oklahoma—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>Pennsylvania—Cont'd.</i>	°	°	°	Ins.	Ins.
Colebrook.....	88	28	61.2	1.72		Jefferson.....	88	32	65.1	7.91		Dushore.....	87	18	56.4	1.25	
Dayton a.....	89	28	65.2	4.66		Jenkins.....	89	34	64.7	8.12		East Bloomsburg.....				0.65	
Dayton b.....	89	27	62.8	4.37		Kenton.....	88	34	60.4	0.73		East Mauch Chunk.....	94	28	62.2	0.55	
Defiance.....	90	27	63.8	4.37		Kingfisher.....	88	28	65.5 ^a	7.29		Easton.....	91	31	62.8	0.77	
Delaware.....	89	28	63.7	1.73		Mangum.....	90 ^a	35 ^a	68.2 ^a	3.45		Ellwood Junction.....				4.12	
Demos.....	89	31	65.7	3.05		Newkirk.....	83	34	61.9	8.87		Emporium.....	89	24	60.3	1.37	
Elyria.....	90	28	62.2	1.84		Norman.....	88	28	67.0	4.62		Ephrata.....	90	28	63.2	0.97	
Findlay.....	92	30	64.4	2.43		Okeeme.....	86 ^a	38 ^a	62.3 ^a	9.99		Everett.....	90	27	60.5	2.24	
Frankfort.....	88	30	64.1	4.00		Pawhuska.....	87	.....	.....	10.57		Forks of Neshaminy.....				0.83	
Fremont.....	92	29	63.4	4.13		Perry.....	82	30	64.2	8.37		Franklin.....	87	23	61.7	1.98	
Garrettsville.....	88	24	60.3	1.27		Sac and Fox Agency.....	90	29	68.8	6.50		Freeport.....	91	28	65.2	2.22	
Granville.....	90	31	64.0	3.56		Shawnee.....	88	30	66.2	7.71		Girardville.....				2.28	
Gratiot.....	87	30	64.4	2.93		Stillwater.....	84	29	64.2	9.27		Grampian.....	86	23	58.0	2.51	
Green.....	91	35	67.9	4.17		Taloga.....	89 ^a	30 ^a	68.4 ^a	8.18		Greensboro.....				3.02	
Greenfield.....	87	35	66.2	4.92		Temple.....	92	31	68.7	3.54		Greenville.....	89	26	61.4	2.09	
Greenhill.....	86	28	61.1	1.50		Ural.....	90	30	63.8	6.31		Hamburg.....	94	29	64.0	0.32	
Greenville.....	89	28	64.2	3.60		Waukomis.....	83	29	64.4	7.51		Hamilton.....	88	22	58.2	1.03	
Hanging Rock.....	92	31	67.6	1.94		Weatherford.....	85	32	62.8	7.99		Hawthorn.....	89	25	60.2	1.99	
Hedges.....	91	25	63.1	3.19		<i>Oregon.</i>						Herrs Island Dam.....				1.82	
Hillhouse.....	84	25	58.9	2.93		Albany b.....						Huntington a.....				1.60	
Hiram.....	86	29	62.0	1.32		Alpha.....	83	32	63.3	2.94		Huntington b.....	93	26	61.5	1.76	
Hudson.....	91	27	62.8	1.32		Arlington.....	94	36	61.2	0.45		Indiana.....	86	31	64.2	.....
Jacksonboro.....	89	29	64.8	4.55		Ashland.....	90	31	67.0	0.37		Irwin.....	90	28	64.7	1.16	
Kenton.....	92	28	64.2	2.74		Astoria.....	71	40	53.4	5.44		Johnstown.....	92	28	63.6	2.36	
Killbuck.....	87	28	63.2	3.06		Aurora (near).....	81	35	55.1	2.73		Keating.....				1.70	
Lancaster.....	89	32	65.2	4.14		Bay City.....	68	33	50.3	6.79		Kennett Square.....	90	32	62.7	3.21	
Lima.....	87	28	65.1	2.49		Bend.....	93	11	48.0	0.05	0.5	Lansdale.....				0.62	
McConnellsburg.....	88	32	64.8	2.86		Beulah.....	97	21	53.2	0.11		Lawrenceville.....	94	20	58.2	1.65	
Manara.....	86	29	64.4	3.98		Blalock.....	98	41 ^a	62.3 ^a	T.		Lebanon.....	93	29	63.4	0.94	
Mansfield.....				2.29		Bullrun.....						Leroy.....	85	22	59.2	2.00	
Marietta.....	88	37	67.2	4.48		Cascade Locks.....	84	39	58.2	2.52		Lewisburg.....	90	26	61.8	2.40	
Marion.....	92	28	64.8	1.99		Coquille.....						Lockhaven a.....	91	30	63.4	1.69	
Medina.....	90	28	63.4	1.53		Corvallis.....	82	32	55.2	1.03		Lockhaven b.....				1.56	
Milfordton.....	88	28	62.0	4.38		Coyote.....	105	36 ^a	63.1 ^a	0.22		Lock No. 4.....				2.80	
Milligan.....	89	27	62.9	3.96		Dayville.....	94	28	54.8	1.00		Lycippus.....	86	31	64.7	1.56	
Millport.....	86	27	60.5	1.87		Doraville.....	82	34	52.6	2.94		Mifflin.....				1.31	
Montpelier.....	88	27	61.9	4.00		Drain.....	87	32	56.8	1.04		Oil City.....				2.62	
Napoleon.....	90	28	63.1	2.31		Ella.....						Ottaville.....				1.91	
New Alexandria.....	91	31	66.2	1.90		Eugene.....	79	35	55.1	1.49		Parker.....				3.02	
New Berlin.....	88	27	62.6	1.54		Fairview.....	78	32	53.0	2.82		Philadelphia.....	93	36	65.9	2.08	
New Bremen.....	90	22	62.1	2.90		Falls City.....	82	33	54.0	1.12		Pocono Lake.....	85	20	55.9	0.82	
New Richmond.....	88	33	67.2	3.93		Forestgrove.....	83	32	55.2	1.57		Point Pleasant.....				0.34	
New Waterford.....	93	26	63.4	2.20		Gardiner.....	73	37	56.0	2.78		Pottsville.....				0.46	
North Lewisburg.....	87	27	63.4	1.95		Glenora.....	82	30	52.4	7.55		Quakertown.....	92	29	63.0	0.69	
North Royalton.....	90	29	62.3	1.43		Government Camp.....	75	25	41.8	5.46	27.0	Reading.....	92	29	64.5	0.70	
Norwalk.....	93	29	63.2	1.98		Grants Pass.....	95	29	56.8	0.24		Renovo b.....				1.76	
Oberlin.....	89	27	61.4	1.99		Grass Valley.....	88	11	48.4	0.04		Saegerstown.....	90	20	59.6	2.71	
Ohio State University.....	87	30	63.0	2.64		Heppner.....	100	28	56.4	0.45		St. Marys.....	84	25	60.3	1.90	
Orangeville.....	89	27	61.4	1.31		Hood River (near).....	91	33	56.4	0.29		Saltsburg.....				1.15	
Ottawa.....	93	27	64.4	4.69		Huntington.....	96	28	59.8	0.14		Seisholtzville.....				0.22	
Pataskala.....	89	30	63.7	3.98		Jacksonville.....	94	34	58.2	0.31		Selinsgrove.....	89	28	63.2	1.28	
Philo.....	92	31	66.4	1.23		Joseph.....	98	21	47.2	0.77	0.6	Shawmont.....				0.63	
Plattsbury.....	89	27	64.3	3.90		Kerby.....	96	31	55.9	0.39		Smethport.....	85	20	56.8	2.70	T.
Pomeroy.....	90	34	66.2	2.76		Lagrange.....	92	28	52.9	1.30		Smiths Corners.....				0.22	
Portsmouth a.....				1.74		Lakeview.....	93	25	51.8	0.53		Somerset.....	87	26	60.6	2.12	
Portsmouth b.....	90	36	69.4	1.66		Langlois.....	71	34	52.0	1.38		South Bethlehem.....	91	30	63.3	0.45	
Pulse.....	87	31	65.9	4.04		Lonerock.....	91	24	50.7	0.68		South Eaton.....	86	28	60.6	1.31	
Richwood.....	91	29	62.8	2.73		McKenzie Bridge.....	89	31	54.8	2.97		Spring Mount.....				1.26	
Ripley.....	87 ^a	33 ^a	65.2 ^a	3.52		McMinnville.....	84	33	55.8	0.91		State College.....	88	28	60.7	1.24	
Rittman.....	92 ^a	28	65.4 ^a	1.80		Monroe.....	80	33	55.2	0.70		Swarthmore.....	92	33	64.0	0.70	
Rockyridge.....	91 ^b	28	63.5 ^b	1.81		Mount Angel.....	81	38	55.4	1.78		Towanda.....	88	22	59.2	0.89	
Shenandoah.....	86	28	62.2	2.67		Nehalem.....						Trottrun.....				1.64	
Sidney.....	91	28	65.4	3.27		Newport.....	64	38	51.2	4.00		Uniontown.....	86	40	65.9	2.66	
Somerset.....	89	32	65.8	3.51		Pendleton.....	90	30	57.8	0.78		Warren.....	86	25	60.1	3.68	
Springfield.....				3.60		Pine.....	92	25	52.4	0.33		Westchester.....	90	33	64.2	2.76	T.
Strongsville.....																	

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>South Carolina—Cont'd.</i>	*	o	o	Ins.	Ins.	<i>Tennessee—Cont'd.</i>	o	o	o	Ins.	Ins.	<i>Texas—Cont'd.</i>	o	o	o	Ins.	Ins.
Gaffney	101	49	70.6	1.73		Clinton	89	38	68.6	3.69		Greenville	93	34	71.0	1.37	
Georgetown	100	45	70.6	2.75		Covington	94	37	68.3	4.43		Hale Center	89	35	66.5	0.35	
Gillisonville	95	52	70.8	4.72		Decatur	85	36	65.9	9.31		Hallettsville	91	46	74.0	2.81	
Greenville	94	45	66.8	1.13		Dickson	88	39	67.2	2.50		Haskell	98	35	69.0	1.43	
Greenwood	96	43	71.6	2.81		Dyersburg	91	37	68.1	3.30		Hearne	94	43	70.2	2.21	
Heath Springs	29	44	60.2	1.14		Elizabethton	88	34	62.8	5.15		Henrietta	96	32	68.2	2.35	
Kingtree b.				1.33		Erasmus	91	38	68.3	6.57		Hewitt				1.64	
Liberty	100	47	71.4	0.60		Florence	91	38	68.3	6.57		Hondo	80 ^b	48 ^b	69.1 ^b	3.08	
Little Mountain	100	52	72.3	2.05		Franklin	88	38	67.9	5.46		Houston	92	46	74.0	2.75	
Longshore	100	52	70.8	2.51		Grace ^a	94	40	71.5	3.10		Huntsville	91	42	71.2	2.44	
Lugoff	100	51	71.2	1.64		Greeneville	91	36	65.8	2.14		Ira	97	34 ^a	68.0	0.92	
Pinopolis ^a	90	56	68.9	5.45		Halla Hill	96	36	67.8	4.93		Jacksonville	88	37	69.8	2.00	
St. Stephens				2.80		Harriman	88	32	65.2	5.22		Jasper	87	45	71.8	1.17	
Santuck	101	47	69.8	2.30		Hohenwald	88	34	66.7	6.99		Junction				3.27	
Seivern	101	47	70.4	3.68		Iron City	91	38	67.2	1.81		Kaufman	90	37	71.7	2.03	
Smiths Mills				2.20		Isabella	91	38	67.2	7.00		Kent	98	35	68.4	0.66	
Society Hill	95	51	71.8	1.81		Jackson	89	31	67.2	7.00		Kerrville	86	33	68.3	2.96	
Spartanburg	99	48	69.4	1.59		Johnsonville	90	34	67.9	7.08		Kopperl				4.90	
Slateburg	99	52	72.0	1.67		Jonesboro	89	37	66.2	2.61		Lampasas	87	32	69.3	3.06	
Summerville	94	53	70.0	5.78		Kenton	87	35	68.2	4.67		Lapara				1.20	
Sumter	104	52	72.9	1.20		Kingston						Laureles Ranch				2.46	
Temperance	96 ^a	51 ^a	69.4 ^a	0.44		Lafayette ^a	91	36	67.8	3.60		Llano	90	28	65.2	0.55	
Trenton	98	54	70.9	2.47		Leadvale						Longview	90	40	70.7	3.57	
Trial	97	49	68.6	2.04		Lebanon	90	36	69.0	6.02		Luling	91	40	72.6	1.73	
Walhalla	95	60.2				Lewisburg	90	35	68.3	5.68		McKinney	91	27	68.1	2.02	
Walterboro	97	54	71.2	3.74		Liberty	91	44	68.6	5.05		Man	89	31	70.1	4.90	
Winnabow	98	50	70.4	1.09		Lynville	88	38	68.2	6.12		Marlin	90	44	71.6	3.93	
Winthrop College	98	50	70.6	0.65		McKenzie	90	35	69.7	4.20		Menardville	90	27	67.6	2.46	
Yorkville	101	52	69.8	1.70		McMinnville	91	35	67.6	4.60		Mount Blanco	91	33	66.2	0.01	
<i>South Dakota.</i>						Maryville	95	38	69.5	2.94		Nacogdoches	87	40	68.8	2.98	
Aberdeen	88	28	60.7	1.28		Milan	91	36	68.0	4.48		New Braunfels	89	44	72.6	1.89	
Academy	84	34	59.6	2.71		Newport	93	40	69.0	2.30		Panter				2.45	
Alexandria	85	29	58.0	4.48		Nunnelly	94	34	67.4	6.00		Paris ^a	92	38	68.7	1.54	
Armour	83	32	58.4	5.03		Oakhill	89	31	68.0	3.44		Pearall	94	46	75.3	2.96	
Ashcroft	94	24	54.9	2.01		Palmetto	89	38	69.0	6.36		Port Lavaca	90	49	74.0	1.06	
Bowdle	99	25	57.2	1.15		Pope	90	30	67.9	5.17		Rhinelander	93	32	67.4	1.95	
Brookings	81 ^a	29	56.6	4.56		Rogersville	90	37	67.1	1.79		Rockisland	88	43	72.6	1.62	
Canton	80	31	59.3	10.02		Rugby	91	30	64.6	4.47		Runge	93 ^a	48 ^a	74.8 ^a	1.92	
Cavite	88 ^a	30 ^a	58.7 ^a			Savannah	91	35	70.0	6.90		Sanderson	87	55	74.4	3.40	
Centerville				7.86		Sewanee	87	34	65.9	5.48		San Saba	89	29	70.0	1.40	
Chamberlain	87	35	61.3	1.18		Silverlake	86	33	62.5	1.21		San Marcos	90	44	72.0	1.53	
Cherry Creek	85	25	56.6	2.44		Springdale	92	34	66.0	2.98		Sherman	85	37	68.0	2.55	
Desmet				4.92		Springville	89	34	68.6	5.81		Sonora	88	32	68.2	5.76	
Doland	84	23	58.3	4.20		Yukon	90	39	68.6	6.25		Sugarland	90	54	73.6	3.30	
Elkpoint	84	30	62.6	8.09		<i>Texas.</i>						Sulphur Springs	87	36	69.5	2.56	
Fairfax	86	31	60.2	5.86		Albany	88	32	69.8	2.58		Temple ^a	85	39	69.6	2.02	
Farmingdale				3.31		Alvin						Temple ^b	87	40	70.0	2.27	
Faulkton	85	26	57.4	0.91		Austin ^a	91	46	73.2	1.91		Trinity	89	40	71.9	4.70	
Flandreau	79	29	56.3	5.39		Ballinger	90	33	68.0	4.44		Tyler	92	38	71.0	3.21	
Forestgate	86	29	59.0	3.43		Beaumont	90	45	72.6	2.74		Victoria	93 ^a	45 ^a	73.8 ^a	2.25	
Fort Meade	83	34	54.8	3.36		Beeville	87	47	65.0	3.43		Waco	91	38	73.0	2.18	
Gann Valley	85	31	60.2	1.26		Bigspring	96	36	70.2	1.55		Waxahachie	91	40	71.8	1.40	
Gettysburg	88	25	57.2	1.47		Blanco	85	35	67.3	1.00		Weatherford	95	34	69.8	1.79	
Grand River School	87	26	57.2	1.32		Boerne ^a	87	47	65.8	2.05		Wharton	90	46	74.6	1.76	
Greenwood	86	36	60.9	6.02		Bonham	90	32	69.8	1.53		Wichita Falls				6.20	
Highmore				0.85		Booth						Utah.					
Hitchcock				1.15		Bowie	93	37	69.2	2.46		Alpine				3.72	
Hotch City	84	31	57.8	0.87		Brazoria	85	46	72.4	1.15		Aneth	89	33	60.4	0.12	
Howard	83 ^a	29 ^a	58.6 ^a	4.92		Brenham	88	43	72.3	2.38		Blackrock	88	28	53.2	1.73	10.0
Howell	85	26	57.4	0.79		Brighton	88	49	74.2	2.34		Bluecreek ^a	97	30	60.5	2.50	
Ipswich	85	24	56.2	1.45		Brownwood	87	38	66.1	1.70		Callao	92	25	54.6	2.56	
Kimball	83	34	58.2	2.34		Burnet	97	35	70.3	1.26		Castledale	87	22	51.6	0.13	
Leola	86	26	57.2	2.25		Camp Eagle Pass	98	53	78.3	3.25		Corinne	93	31	55.0	3.01	
Marion	84 ^a	36 ^a	60.1 ^a	8.74		Childress	92	34	67.7	1.69		Coyote	83 ^a	18 ^a	48.4 ^a	0.53	
Mellette	85	28	57.8	1.90		Clarksville	87	35	65.4	2.70		Emery	76	22	47.4	0.65	
Menno	85	30	59.8	7.46		Coleman</											

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Utah—Cont'd.</i>	°	°	°	In.	In.	<i>Washington—Cont'd.</i>	°	°	°	In.	In.	<i>West Virginia—Cont'd.</i>	°	°	°	In.	In.
Parowan	86	25	53.2	1.10	4.0	Coupeville	73	38	52.2	1.78		Uneda	°	°	°	2.21	
Pinto	82°	19°	49.7°	0.80		Crescent	95	28	53.2	0.97		Uppertract	91	27	62.2	3.34	
Plateau	89	19	46.4	2.60	15.0	Danville	91	30	54.0	1.13		Valley Fork	87	32	65.7	3.60	
Provo	90	30	53.9	2.69		Dayton	94	29	55.6	0.81		Webster Springs	88	33	64.0	3.50	
Ranch	78	16	50.2	1.40		East Sound	72°	31°	51.8°	1.37		Wellsburg	85	32	63.9	2.17	
Richfield	88	29	54.2	1.39		Ellensburg	89	27	53.4	0.10		Weston				5.16	
St. George	100	31	65.6	0.32		Ephrata	95	33	59.9	0.15		Wheeling a				2.16	
Scipio	89	25	52.4	1.96		Grandmound	80	31	53.6	2.36		Wheeling b	92	47	72.8	2.05	
Snowville	87	19	49.6	1.69		Granite Falls				7.88		Williamson	92	35	70.6	0.90	
Soldier Summit	84	24	54.2			Hooper	98	32	57.6	0.40		<i>Wisconsin.</i>					
Terrace	88	29	54.5	3.05		Ilwaco	70	38	51.8	5.41		Amherst	82	25	55.9	5.03	
Thistle	90	35	56.7	1.60	4.0	Lacenter	83	35	53.8	2.92		Antigo	83	17	57.2	3.98	
Tooele	88	32	54.0	1.60		Lakeside	85	38	58.0	0.18		Appleton	81	27	56.4	3.56	
Tropic	84	26	51.0	0.53	T.	Lind	101	28	59.6	0.35		Ashland				6.77	
Vernal	88	30	55.0	1.30		Loomis	88	36	57.7	0.20		Barron	82	22	57.4	5.86	
Wellington	87 ^b	24 ^b	53.2 ^b	0.82		Mayfield	83	37	53.4	2.40		Beloit	83	31	61.1	3.53	
Woodruff	84	18	45.4	1.08	6.0	Metting Ranch	101	35	62.0	0.40		Brodhead	88	28	62.5	4.37	
<i>Vermont.</i>						Moxee	91	26	56.2	0.10		Butternut	83	11	52.1	8.88	
Burlington	85	29	61.8	T.	Northport	93	30	53.1	1.71		Chilton	84	27	57.8	3.66		
Cavendish	89	19	56.8	0.33		Odessa	95 ^a	34	57.7 ^a	0.05		Chippewa Falls				4.42	
Chelsea	83	19	55.4	0.29		Olga	66	41	51.5	1.59		Darlington	84	24	61.2	3.99	
Cornwall	90	26	60.8	0.24		Olympia	82	33	54.8	2.16		Delavan	87	30	60.8	3.61	
Derby	84	26	57.6	0.20		Pasco	105	45	70.2	0.03		Dodgeville	83	30	61.2	4.90	
Enosburg Falls	86	15	54.6	0.45	T.	Pinehill	91	34	57.3	0.11		Downing	84	26	56.0	7.14	
Hartland	86	18	56.1	0.29		Pomeroy	95	31	56.4	0.68		Easton	85	27	59.2	5.46	
Jacksonville	85	27	54.0	0.70		Port Townsend	72	37	52.0	1.71		Eau Claire	84	28	59.7	7.03	
Manchester	84	22	57.2	0.86		Pullman	85 ^a	31°	52.6 ^a	2.27		Florence	82	17	64.0	7.00	
Morrisville	89	18	57.6	0.12		Republic	90	27	52.0	0.76		Fond du Lac	84	36	59.8	3.66	
Norwich	87	18	55.0	0.76		Ritzville				7.82		Grand Rapids	83	27	58.4	6.85	
St. Johnsbury	87	19	56.8	0.04		Ritzville (near)						Grand River Locks					
Wells	86	25	58.0	0.43		Rosalia	90	26	52.0	2.22		Grantsburg	77	23	55.0	6.55	
Woodstock	87	20	57.0	0.80		Sedro Woolley	78	34	53.8	2.77		Hancock	83	27	58.2	4.66	
<i>Virginia.</i>						Sylvania	78	35	52.5	3.18		Harvey	84	29	59.6	4.53	
Alexandria	92	38	66.0	3.75		Snoshomish	78	35	53.0	3.25		Hayward	84	12	55.2	6.18	
Ashland	91	38	65.7	2.79		Snoqualmie	82	32	54.9	4.40		Hillsboro	84	28	58.2	5.23	
Barbourville	89	36	67.7	5.80		Southbend	79 ^a	34 ^a	52.4 ^a	5.87		Koepnick	84	10	56.6	7.00	10.0
Bedford	98	38	68.8	0.77		Sprague				1.20		Lancaster	83	29	60.8	5.52	
Bigstone Gap	92	35	66.3	2.60		Sunnyside	91	29	57.8	0.14		Madison	80	33	59.8	4.38	
Blacksburg	88	32	61.6	0.88		Trinidad	95	30	64.6	T.		Manitowoc	79	27	51.6	2.73	
Bluemont	90 ^c	33 ^c	63.2 ^c	3.37		Twisp	87	30	54.4	0.21		Meadow Valley	84	25	58.4	5.99	
Bonair	90	38	65.9	3.08		Union	80 ^a	35 ^a	53.9 ^a	2.73		Medford	84	23	57.8	8.25	
Boykins			1.75			Wilmington	90 ^a	23 ^b	50.9 ^b	1.39		Menasha	87	28	53.4	4.23	
Buckingham	95	31	65.7	2.74		Bayard	86	23	57.7	3.83	T.	Neillsville	84	26	60.0	6.04	
Burkes Garden	82	28	58.9	1.66		Beverly	85	27	60.3	5.22		New London	84	26	56.6	4.15	
Callaville	90	36	65.1	0.85		Buckhannon	89	31	66.0	6.24		Oconto	85	24	56.0	4.80	
Charlottesville	90	36	65.0	1.76		Burlington	86	26	62.3	2.62		Osecola	77	22	53.9	7.31	
Clarksville			1.49			Byrne	95	33	67.7	3.58		Oshkosh	83	28	55.0	3.70	
Columbia	99	28	64.0	3.50		Cairo	92	28	67.1	2.40		Pine River	84	28	56.7	4.31	
Dale Enterprise	88	30	62.6	3.74		Central	88	30	64.4	5.23		Portage	84	31	61.0	4.96	
Danville			2.88			Charleston a				1.83		Port Washington	80	35	53.0	3.47	
Farmville	93	32	65.9	2.05		Charleston b						Prairie du Chien a	87	28	63.4	5.23	
Fredericksburg	93	37	65.7	2.74		Chestnut						Prairie du Chien b				5.38	
Grahams Forge	90	30	63.0	0.92		Chestnut						Racine	90	32	57.0	2.39	
Hampton	90	42	66.9	1.80		Cheyenne						Sheboygan	79	30	52.3	3.62	
Hot Springs	86	36	61.6	1.25		Cheyenne						Spooner	88	21	56.2	2.65	
La Crosse	94	39	67.8	2.60		Chestnut						Stevens Point	83	24	57.2	5.59	
Lexington	93	32	64.4	1.50		Chestnut						Tomahawk	82	11	55.1	5.50	
Lincoln	92	31	63.1	2.01		Chestnut						Valley Junction	84	29	58.4	4.88	
Manassas	91	35	63.6	4.02		Chestnut						Viroqua	80	26	58.8	6.41	
Marion	90 ^c	34 ^c	64.6 ^c	0.50		Chestnut						Watertown	84	27	58.7	4.91	
Mendoza			1.10			Chestnut						Waukesha	83	28	58.4	4.57	
Newport News	93	47	68.7	2.70		Chestnut						Waupaca	85	24	57.4	5.88	
Petersburg	98 ^c	40 ^c	66.8 ^c	3.00		Chestnut						Wausau	84	22	56.7	6.87	
Quantico	94	42	65.2 ^c	6.52	T.	Chestnut						Whitehall	82	25	59.2	5.70	
Radford			2.96			Chestnut						<i>Wyoming.</i>					
Riverton			2.67			Chestnut						Afton	79	24	45.2	2.71	7.0
Roanoke	89	36	62.3	0.98		Chestnut						Alcova	88	12	50.6	1.42	T.
Rockymount	86	33															

TABLE II.—Climatological record of voluntary and other cooperating observers—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipita- tion.		Stations.	Temperature. (Fahrenheit.)			Precipita- tion.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.		Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
<i>Wyoming—Cont'd.</i>	°	°	°	Ins.	Ins.	<i>West Indies.</i>	°	°	°	Ins.	Ins.
Thayne	80	20	44.2	2.18		Isle of Pines, Cuba	92	65	79.0	3.10	
Thermopolis	84	18	47.4	3.16		Consuelo S. P. Macori S. D.	92	60	78.4	10.40	
<i>Porto Rico.</i>											
Adjuntas	88	51	74.2	6.76							
Aguadilla	94	59	77.8	8.42							
Aguirre	94	66	81.7	2.36							
Arecibo	92	68	79.0 ^f	8.43							
Barros	88	48	73.1	5.53							
Bayamon	89	56	75.0	5.20							
Caguas	97	51	79.7	3.69							
Canovanas	97	67	82.7	0.93							
Cayey	95	50	75.2	0.62							
Cidra	86	50	69.4	2.20							
Coamo	93	57	70.2	0.21							
Corozal	95	55	77.4	2.58							
Fajardo	93	60	80.9	5.90							
Guánica	92	58	79.4	2.49							
Hacienda Josefina				2.36							
Hacienda Perla	99	62	81.0	10.34							
Humacao	93	70	83.0	5.80							
Isabela	91	65	77.8	12.08							
Juan Diaz	91	65	80.1	3.02							
La Carmelita	86	59	74.4	11.75							
Las Marias	91	60	77.4	10.67							
Manati	98	60	79.3	4.98							
Maunabo	95	66	77.2	7.36							
Mayaguez	97	63	79.9	11.58							
Morovis	95	57	77.7	9.58							
Ponce	90	62	80.0	1.23							
Rio Piedras				9.35							
San German	94	66	82.6	4.53							
San Lorenzo	95	53	77.6	4.93							
San Salvador	89	60	75.5	8.49							
Santa Isabel	93	61	80.2	3.24							
Utuado	94	56	76.6	11.70							
Vieques	92	66	80.5	3.31							
Yauco	80	63	79.8	5.04							
<i>Mexico.</i>											
Ciudad P. Diaz	92	40	69.4	2.45							
Coatzacoalcos	98	67	79.9	0.80							
Leon de Aldamas	96	49	72.1	0.51							
Vera Cruz	89	61	79.0	0.30							
<i>New Brunswick.</i>											
St. John	70	32	48.3	2.77							
<i>Isthmus of Panama.</i>											
Alajuela	95	73	81.0	7.84							
Bohio				9.76							
Colon				14.76							
Gambon				11.10							
La Boca	88	73	79.3	6.70							
<i>West Indies.</i>											
Consuelo S. P. Macori S. D.	92	50	76.8	5.40							

EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

1 Mean of 7 a. m. + 2 p. m. + 9 p. m. + 4 p. m. + 4.

2 Mean of 8 a. m. + 8 p. m. + 2.

3 Mean of 7 a. m. + 7 p. m. + 2.

4 Mean of 6 a. m. + 6 p. m. + 2.

5 Mean of 7 a. m. + 2 p. m. + 2.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "14" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

NOTE.—The following change has been made in the names of stations: Indiana, Prairie Creek changed to Farmersburg near.

CORRECTIONS.

April, 1903, Utah, Grover, make maximum temperature 75 instead of 95.

TABLE III.—Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of May, 1903.

Stations.	Component direction from—				Resultant.		Stations.	Component direction from—				Resultant.							
	N.	S.	E.	W.	Direction from—	Duration.		N.	S.	E.	W.	Direction from—	Duration.						
<i>New England.</i>																			
Eastport, Me.	19	22	15	20	s. 59 w.	6	Moorhead, Minn.	20	22	26	14	s. 81 e.	12						
Portland, Me.	19	30	9	12	s. 15 w.	11	Bismarck, N. Dak.	20	18	20	16	n. 63 e.	4						
Concord, N. H.	17	8	11	4	n. 38 e.	11	Williston, N. Dak.	14	21	19	21	s. 16 w.	7						
Northfield, Vt.	19	32	14	6	s. 32 e.	15	<i>Upper Mississippi Valley.</i>												
Boston, Mass.	16	22	18	21	s. 27 w.	7	Minneapolis, Minn.*	13	11	10	3	n. 74 e.	7						
Nantucket, Mass.	16	21	21	15	s. 45 e.	8	St. Paul, Minn.	17	25	29	11	s. 66 e.	20						
Block Island, R. I.	13	26	25	14	s. 45 e.	16	La Crosse, Wis. †	7	20	9	1	s. 32 e.	15						
Narragansett, R. I.*	6	15	10	8	s. 13 e.	9	Davenport, Iowa.	14	21	29	9	s. 71 e.	21						
New Haven, Conn.	22	21	20	13	n. 82 e.	7	Des Moines, Iowa.	8	31	23	11	s. 28 e.	26						
<i>Middle Atlantic States.</i>																			
Albany, N. Y.	19	29	13	12	s. 6 e.	10	Dubuque, Iowa.	13	27	29	9	s. 55 e.	24						
Binghamton, N. Y. †	14	10	7	6	n. 14 e.	4	Keokuk, Iowa.	13	29	23	14	s. 29 e.	18						
New York, N. Y.	12	24	23	16	s. 30 e.	14	Cairo, Ill.	11	34	26	6	s. 41 e.	30						
Harrisburg, Pa.	16	23	24	12	s. 60 e.	14	Springfield, Ill.	13	31	19	9	s. 29 e.	21						
Philadelphia, Pa.	19	24	22	11	s. 66 e.	12	Hannibal, Mo. †	7	12	15	5	s. 63 e.	11						
Scranton, Pa.	25	13	27	10	n. 55 e.	21	St. Louis, Mo.	11	35	21	4	s. 35 e.	29						
Atlantic City, N. J.	17	18	23	16	s. 82 e.	7	<i>Missouri Valley.</i>												
Cape May, N. J.	18	24	23	10	s. 65 e.	14	Columbia, Mo. *	3	15	14	3	s. 43 e.	16						
Baltimore, Md.	21	23	21	12	s. 13 e.	9	Kansas City, Mo.	9	31	30	4	s. 50 e.	34						
Washington, D. C.	16	23	24	13	s. 58 e.	13	Springfield, Mo.	11	35	29	4	s. 46 e.	35						
Cape Henry, Va. †	10	8	11	9	n. 45 e.	3	Topeka, Kans. *	6	17	9	2	s. 32 e.	13						
Lynchburg, Va.	13	18	34	13	s. 77 e.	22	Lincoln, Nebr.	16	31	24	5	s. 52 e.	24						
Norfolk, Va.	17	19	34	6	s. 86 e.	28	Omaha, Nebr.	15	35	16	9	s. 19 e.	21						
Richmond, Va.	19	23	24	8	s. 76 e.	16	Valentine, Nebr.	22	17	19	17	n. 22 e.	5						
Wytheville, Va.	10	14	32	17	s. 75 e.	16	Sioux City, Iowa †	10	13	13	4	s. 72 e.	10						
<i>South Atlantic States.</i>																			
Asheville, N. C.	11	28	30	8	s. 52 e.	28	Pierre, S. Dak.	17	20	19	19	s. 18 e.	3						
Charlotte, N. C.	18	21	27	11	s. 79 e.	16	Huron, S. Dak.	24	18	23	11	n. 63 e.	13						
Hatteras, N. C.	20	17	28	14	n. 78 e.	14	Yankton, S. Dak. †	9	11	13	6	s. 74 e.	7						
Kittyhawk, N. C. *	12	9	15	7	n. 69 e.	8	<i>Northern Slope.</i>												
Raleigh, N. C.	16	16	27	17	e.	10	Havre, Mont.	18	14	9	35	n. 81 w.	26						
Wilmington, N. C.	22	19	28	12	n. 79 e.	16	Miles City, Mont.	12	23	10	27	s. 57 w.	20						
Charleston, S. C.	15	20	32	12	s. 76 e.	21	Helena, Mont.	13	19	10	35	s. 77 w.	26						
Columbia, S. C.	13	19	37	8	s. 78 e.	30	Kalispell, Mont.	7	19	13	35	s. 61 w.	25						
Augusta, Ga.	18	19	34	8	s. 88 e.	26	Rapid City, S. Dak.	16	16	14	30	w.	16						
Savannah, Ga.	13	20	30	14	s. 66 e.	18	Cheyenne, Wyo.	28	12	8	23	n. 43 w.	22						
Jacksonville, Fla.	14	20	32	9	s. 55 e.	28	Lander, Wyo.	16	23	12	24	s. 60 w.	14						
<i>Florida Peninsula.</i>																			
Jupiter, Fla.	21	11	37	9	n. 70 e.	30	North Platte, Nebr.	19	22	14	23	s. 72 w.	10						
Key West, Fla.	18	9	37	11	n. 71 e.	28	<i>Middle Slope.</i>												
Tampa, Fla.	21	5	31	17	n. 41 e.	21	Denver, Colo.	21	22	16	15	s. 45 e.	1						
<i>Eastern Gulf States.</i>																			
Atlanta, Ga.	11	22	30	14	s. 56 e.	19	Pueblo, Colo.	20	14	18	26	n. 53 w.	10						
Macon, Ga. †	12	7	14	3	n. 66 e.	12	Concordia, Kans.	15	33	16	7	s. 27 e.	20						
Pensacola, Fla. †	10	8	16	2	s. 82 e.	14	Dodge, Kans.	21	27	21	9	s. 63 e.	13						
Mobile, Ala.	23	26	18	5	s. 77 e.	13	Wichita, Kans.	16	33	18	5	s. 38 e.	22						
Montgomery, Ala.	15	17	25	19	s. 72 e.	6	Oklahoma, Okla.	19	32	16	5	s. 40 e.	17						
Meridian, Miss. †	7	14	14	5	s. 52 e.	11	<i>Southern Slope.</i>												
Vicksburg, Miss.	10	27	29	9	s. 50 e.	26	Abilene, Tex.	15	31	22	12	s. 32 e.	19						
New Orleans, La.	15	30	28	8	s. 53 e.	25	Amarillo, Tex.	18	32	13	14	s. 4 w.	14						
<i>Western Gulf States.</i>																			
Shreveport, La.	11	27	29	12	s. 47 e.	23	El Paso, Tex.	20	9	18	31	n. 50 w.	17						
Fort Smith, Ark.	12	20	33	6	s. 73 e.	28	Santa Fe, N. Mex.	13	30	21	17	s. 13 e.	18						
Little Rock, Ark.	12	25	29	8	s. 59 e.	25	Flagstaff, Ariz.	10	12	27	22	s. 68 e.	5						
Corpus Christi, Tex.	8	37	29	6	s. 38 e.	37	Phoenix, Ariz.	8	30	6	33	s. 51 w.	35						
Fort Worth, Tex.	17	31	14	13	s. 4 e.	14	Independence, Cal.	22	11	11	33	n. 64 w.	25						
Galveston, Tex.	5	36	26	13	s. 23 e.	34	Carson City, Nev.	21	12	4	32	n. 72 w.	29						
Palestine, Tex.	18	30	16	10	s. 27 e.	13	Winnemucca, Nev.	29	13	17	22	n. 17 w.	17						
San Antonio, Tex.	20	24	30	9	s. 79 e.	21	Modena, Utah.	5	17	9	41	s. 69 w.	34						
Taylor, Tex. †	11	15	8	5	s. 37 e.	5	Salt Lake City, Utah.	24	15	20	16	n. 45 e.	6						
<i>Ohio Valley and Tennessee.</i>																			
Chattanooga, Tenn.	15	25	18	18	s.	10	Grand Junction, Colo.	13	16	20	26	s. 63 w.	7						
Knoxville, Tenn.	20	18	23	7	n. 63 w.	4	<i>Middle Plateau.</i>												
Memphis, Tenn.	8	31	28	7	s. 42 e.	31	Baker City, Oreg.	25	24	16	15	n. 45 e.	1						
Nashville, Tenn.	12	27	26	11	s. 45 e.	21	Boise, Idaho.	16	16	15	32	w.	17						
Lexington, Ky. †	3	17	13	5	s. 30 e.	16	Lewiston, Idaho †	4	10	19	4	s. 68 e.	16						
Louisville, Ky.	15	25	24	8	s. 58 e.	19	Pocatello, Idaho.	2	26	25	22	s. 9 e.	20						
Evansville, Ind. †	7	16	14	2	s. 53 e.	15	Spokane, Wash.	10	29	14	23	s. 25 w.	21						
Indianapolis, Ind.	12	29	26	6	s. 50 e.	26	Walla Walla, Wash.	9	40	13	14	s. 2 w.	31						
Cincinnati, Ohio.	12	19	36	11	s. 74 e.	26	<i>North Pacific Coast Region.</i>												
Columbus, Ohio.	10	28	30	9	s. 49 e.	28	North Head, Wash.	27	15	6	30	n. 63 w.	27						
Pittsburg, Pa.	18	23	19	15	s. 39 e.	6	Port Crescent, Wash. *	5	3	6	23	n. 83 w.	17						
Parkersburg, W. Va.	18	25	21	9	s. 60 e.	14	Seattle, Wash.	14	30	23	13	s. 32 e.	19						
Elkins, W. Va.	22	23	15	12	s. 72 e.	3	Tacoma, Wash.	23	19										

TABLE IV.—*Thunderstorms and auroras, May, 1903.*

States.	No. of stations.	Total.																																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	No. Days.			
Alabama	52	T.	1			1	1	1			2	4	5							1									6	11	11	44	11	T.		
Arizona	56	T.		3	7	5	1	1	2	2		1	1	10		1													0	0	0	4	40	T.		
Arkansas	57	T.			2	4	5	1		2	7	3	5	2	4	5	10	2	14	8	2	1		1	1	10	12	22	8	2	133	24	T.			
California	167	T.		2	1															3	2	3	3	5			1		3	1	24	10	T.			
Colorado	81	T.	1		1	3	4	2	2	4	3	1			9	6	2		1	1	1	4	11	1	8	3	2	70	21	T.						
Connecticut	21	T.					11						4	2				3	16	3									12	2	1	54	9	T.		
Delaware	5	T.				3								2						1	2	4					1	3	3	19	8	T.				
Dist. of Columbia	4	T.		1																1	1								0	0	0	5	5	T.		
Florida	47	T.	1	1	4	11	5	5	9	6	6			4	4	8	5	1									1	2	3	3	12	91	T.			
Georgia	55	T.		5	4		7							6	4				4	3	2		1	10	7	11	5	8	10	87	15	T.				
Idaho	34	T.		1	3							1	4		1					1	1	1		1	1		1	17	12	T.						
Illinois	92	T.		1				5	9	7	10	4	1	1	7	2	7	1	11	33	22	22	28	33	11	3	18	13	4	10	263	24	T.			
Indiana	58	T.					1					1	4	1	3	4	2	12	12	25	12	11	16	21	7	31	8	10	9	11	200	1	A.			
Indian Territory	11	T.					1				2	1	1	1	1	1	3	2	3	5	2			1		2	3	7			36	0	A.			
Iowa	149	T.	1	3	3	8			4	30	19	30	22	16	4		2	19	8	14	28	24	43	25	18	34	41	26	8	10	2	441	26	T.		
Kansas	77	T.	3	1	3	5	3	1		1	5	4	1	1	1	6	1	4	2	6	6	7	4	3	4	8	1	7	4	3	95	27	T.			
Kentucky	41	T.		2										1	1	2		1	4	9	5	1			14	12	12	8	11	83	14	T.				
Louisiana	46	T.		2	6	9	6	5	1		2	3	4	2			1	1			1				1	4	8	12	5	73	18	T.				
Maine	19	T.				3						1				8	8	2	3											25	6	T.				
Maryland	48	T.	12	2									2	2	1	1	3	3	1	19	10	23		3	15	15	20	6	138	17	T.					
Massachusetts	48	T.			19								27	7			25	8							21			107	6	T.						
Michigan	106	T.	1	4	3	1		1		5	1	3	3	3		17	9	28	11	10	19	18	1	14	24	31	4	1		211	22	T.				
Minnesota	67	T.	2	9	8			8	16	9	7	3	2		5	8	10	14	5	4	20	14	12	14	19	4			193	21	T.					
Mississippi	44	T.			2	2	3	6		3	2	9	4			2									4	9	21	7	74	13	T.					
Missouri	95	T.	4	3	16	1		4	3	21	10	8	5	9	20	35	26	26	32	40	18	18	23	36	20	32	21	33	30	12	506	27	T.			
Montana	40	T.	1	2			1	1			1	2	2		1	1	2		1	3	4	1	1		1					25	6	T.				
Nebraska	142	T.	9	4	9	18	15	3		12	30	6	8	2		2	8	10	25	7	13	37	30	6	9	30	31	12	20	15	2	1	374	28	T.	
Nevada	40	T.									1									1	1	1	1	4	1			1	1		12	0	A.			
New Hampshire	19	T.				8						8	2			3	2												12		35	6	T.			
New Jersey	51	T.		1	1	4						1	4	2		6	3	10	1	9	1					17	4	1	1	65	15	T.				
New Mexico	31	T.		1	1	3	1		1	1			1	4	2										1			2	18	11	T.					
New York	99	T.				2	1					18	1		13	6	8	9	9	2			6	13	24				112	13	T.					
North Carolina	56	T.	8	8	2		2			1	1	1	1		1	1		7	8	12	22	29	7	5	15	20	13	12	14	190	22	T.				
North Dakota	48	T.					1	2				1	6	6	3	1		8	7			2	3		1	2			43	13	T.					
Ohio	128	T.	8								3	2		2	1	8	2	21	51	28	30	37	28	37	23	15	3	2	301	18	T.					
Oklahoma	23	T.		3	4	4	1		2	3	1	1	1	2	10	1	8	2	5	10	4	8	5	1	3	2	8	3	0	92	24	T.				
Oregon	74	T.										1													1		4	5	11	4	T.					
Pennsylvania	91	T.	6	1	5	1					2	14	2			21	7	14	9	19	10	14	3	2	6	15	8			159	19	T.				
Rhode Island	7	T.														3	4													7	2	T.				
South Carolina	46	T.	1	5	8	2	1	1			1		1	1	1				10	4	3	8	12	8	13	4	2	1	87	20	T.					
South Dakota	56	T.	1	1	4			5	8	7	3	1			8	3	9	6		17	19	6	11	6	14	3	7	4	4	1	148	23	T.			
Tennessee	56	T.	1	4		4					1	2	1	2	3		6	3	17	1		2			2	20	22	17	16	124	18	A.				
Texas	95	T.	1	7	16	2		8	25	12	2			5	11	11		3	2		4	2			1	16	22	13	2	1	166	21	T.			
Utah	47	T.											2	8		9	3	2		1	10	5	7	2	2		4		2	58	14	T.				
Vermont	16	T.											1	1			1	2			1								0	0	A.					
Virginia	50	T.	2	10			2							1			1	1	2	5	13	14	21	8	3	12	12	14	15	2	138	18	T.			
Washington	64	T.			1									4									1	1			3	5	15	6	A.					
West Virginia	43	T.	18	1									4	7			2	5	1	5	21	16	18	11	9	5	7	10	4	10	154	18	A.			
Wisconsin	60	T.	1	1	1	13	1		2	14	21	18	15	7	1	2	4	16	11	12	6	13	16	26	3	22	31	22	4		283	26	T.			
Wyoming	31	T.			1				1	1						1	2	4	4				1	3		2		1	1	1	1	1	23	13	T.	
Sums	2890	T.	14	20	115	94	115	74	82	52	117	143	130	97	85	146	105	126	161	200	237	251	332	393	289	289	304	310	339	411	297	199	163	5690	...	T.
		A.	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	...	T.		

TABLE V.—Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during May, 1903, at all stations furnished with self-registering gages.

Stations.	Date.	Total duration.		Total amount of precipita- tion.	Excessive rate.		Amount before excessive be- gan.	Depths of precipitation (in inches) during periods of time indicated.														
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.	
		1	2	3	4	5	6	7														
Albany, N. Y.	4			0.06																0.06		
Alpena, Mich.	2-3			0.98															*			
Asheville, N. C.	13-14			0.22															0.16			
Atlanta, Ga.	31	3:48 p. m.	8:07 p. m.	1.60	6:15 p. m.	6:45 p. m.	0.17	0.16	0.36	0.58	0.73	1.22	1.37	1.40	1.42							
Atlantic City, N. J.	30			0.12																		
Augusta, Ga.	28	5:55 p. m.	6:25 p. m.	0.65	5:58 p. m.	6:15 p. m.	T.	0.09	0.29	0.59	0.64	0.65										
Baltimore, Md.	24	2:30 a. m.	4:20 a. m.	1.63	2:53 a. m.	3:30 a. m.	0.03	0.21	0.58	0.80	0.87	0.93	1.22	1.44	1.51	1.54						
Binghamton, N. Y.	14			0.15																		
Bismarck, N. Dak.	17-18			0.85																0.14		
Block Island, R. I.	30			0.64																0.48		
Boise, Idaho	26-27			0.23																0.50		
Boston, Mass.	28			0.06																0.05		
Buffalo, N. Y.	26-27			1.05																0.38		
Cairo, Ill.	27			0.62																0.58		
Charleston, S. C.	13			0.66																0.39		
Charlotte, N. C.	23			0.12																0.12		
Chattanooga, Tenn.	29	1:40 p. m.	5:22 p. m.	1.06	2:18 p. m.	2:55 p. m.	0.09	0.29	0.38	0.48	0.51	0.61	0.65	0.72								
Chicago, Ill.	30	1:55 p. m.	4:45 p. m.	1.88	2:07 p. m.	3:00 p. m.	0.01	0.06	0.13	0.27	0.37	0.60	0.90	1.15	1.43	1.53	1.68	1.78				
Cincinnati, Ohio	25			0.30																0.22		
Cleveland, Ohio	27	6:25 p. m.	9:30 p. m.	1.42	6:51 p. m.	7:25 p. m.	0.12	0.08	0.15	0.25	0.43	0.55	0.72	0.98	0.99							
Columbia, Mo.	29			0.45																0.31		
Columbia, S. C.	25	10:50 a. m.	12:15 p. m.	1.96	11:04 a. m.	12:05 p. m.	0.01	0.20	0.54	0.67	0.85	1.04	1.27	1.46	1.60	1.65	1.72	1.94				
Columbus, Ohio	25	6:30 p. m.	10:20 p. m.	1.35	6:45 p. m.	7:25 p. m.	0.05	0.13	0.28	0.42	0.58	0.74	0.87	0.98	1.03							
Corpus Christi, Tex.	10	11:00 a. m.	1:35 p. m.	2.15	11:50 a. m.	12:45 p. m.	0.06	0.18	0.48	0.69	0.94	1.01	1.22	1.55	1.76	1.88	1.92	2.02				
Davenport, Iowa	26			0.73																0.51		
Denver, Colo.	31			0.39																0.18		
Des Moines, Iowa	21-22	11:55 p. m.	D. N.	1.38	1:08 a. m.	2:30 a. m.	0.10	0.08	0.17	0.44	0.66	0.72	0.77	0.82	0.86	0.89	0.93	0.99	1.27			
Detroit, Mich.	27			0.38																0.32		
Dodge, Kans.	26			0.56																0.56		
Dubuque, Iowa	26-27			1.60																0.67		
Duluth, Minn.	23			0.27																0.21		
Eastport, Me.	4-5			2.13																0.34		
Elkins, W. Va.	29	7:17 p. m.	8:15 p. m.	0.65	7:19 p. m.	7:38 p. m.	T.	0.23	0.42	0.57	0.63	0.64								0.57		
Erie, Pa.	26-27	8:30 p. m.	D. N.	2.07	8:32 p. m.	9:05 p. m.	T.	0.30	0.63	1.28	1.38	1.45	1.51	1.61	1.64						0.42	
Escanaba, Mich.	18			0.51																0.30		
Evensville, Ind.	27			0.58																0.54		
Fort Smith, Ark.	19	1:13 a. m.	5:19 a. m.	1.36	1:15 a. m.	2:05 a. m.	0.01	0.07	0.21	0.23	0.28	0.32	0.44	0.55	0.67	0.72	0.78	0.84				
Fort Worth, Tex.	28			1.13																0.42		
Galveston, Tex.	11			0.35																0.30		
Grand Haven, Mich.	23			0.54																0.24		
Grand Junction, Colo.	21			0.25																0.33		
Green Bay, Wis.	23			0.99																0.16		
Harrisburg, Pa.	24			0.21																0.70		
Hatteras, N. C.	3			3.11																		
Huron, S. Dak.	26			0.25																		
Indianapolis, Ind.	25	6:22 a. m.	9:02 a. m.	0.95	6:32 a. m.	7:10 a. m.	0.09	0.15	0.36	0.52	0.58	0.62	0.65	0.70								
Jacksonville, Fla.	12-13	12:17 p. m.	10:30 a. m.	8.93	12:15 a. m.	12:50 a. m.	2.34	0.10	0.22	0.34	0.41	0.49	0.59	0.66								
Jupiter, Fla.	14	2:29 p. m.	3:25 p. m.	1.05	2:56 p. m.	3:15 p. m.	0.01	0.21	0.58	0.86	1.01	1.02										
Kalispell, Mont.	9			0.10																0.08		
Key West, Fla.	23			0.17																0.52		
Knoxville, Tenn.	29	5:30 p. m.	9:25 p. m.	0.83	5:39 p. m.	6:00 p. m.	0.01	0.11	0.14	0.30	0.51	0.54	0.56	0.58						0.16		
La Crosse, Wis.	26	6:23 p. m.	11:55 p. m.	1.39	8:27 p. m.	8:50 p. m.	0.02	0.08	0.31	0.46	0.53	0.62	0.65	0.70								
Lexington, Ky.	29			0.30																0.13		
Lincoln, Nebr.	24-25	10:42 p. m.	D. N.	1.37	10:52 p. m.	11:35 p. m.	T.	0.18	0.32	0.40	0.51	0.57	0.82	0.91	0.96	1.01	1.03					
Little Rock, Ark.	29	6:50 p. m.	11:30 p. m.	1.13	8:12 p. m.	8:38 p. m.	0.25	0.31	0.39	0.42	0.53	0.75	0.76	0.78	0.82							
Louisville, Ky.	31	7:12 p. m.	10:30 p. m.	1.52	7:13 p. m.	7:30 p. m.	T.	0.60	0.89	1.05	1.09	1.10										
Lynchburg, Va.	27			0.66																0.65		
Macon, Ga.	14-15	8:05 p. m.	5:15 a. m.	1.51	2:15 a. m.	2:35 a. m.	0.76	0.06	0.28	0.50	0.62	0.63										
Memphis, Tenn.	28	12:08 p. m.	D. N.	0.69	12:09 p. m.	12:31 p. m.	T.	0.13	0.31	0.56	0.66	0.68										
Meridian, Miss.	29-30	8:05 p. m.	D. N.	1.30	10:05 p. m.	10:35 p. m.	0.12	0.10	0.20	0.32	0.46	0.51	0.60	0.64								
Milwaukee, Wis.	23	10:30 a. m.	11:30 a. m.	0.81	10:45 a. m.	11:05 a. m.	0.01	0.08	0.36	0.66	0.76	0.79										
Montgomery, Ala.	14			1.53																0.63		
Nantucket, Mass.	30			0.83																0.35		
Nashville, Tenn.	30	6:05 p. m.	9:45 p. m.	1.86	7:10 p. m.	7:35 p. m.	0.70	0.16	0.44	0.60	0.74	0.79	0.83	0.86	0.90	0.91						
New Haven, Conn.	28			0.20																0.08		
New Orleans, La.	7			0.56																0.27		
New York, N. Y.	22			0.08																0.08		
Norfolk, Va.	24	9:55 p. m.	11:55 p. m.	1.13	9:58 p. m.	10:20 p. m.	T.	0.26	0.64	0.86	0.93	0.97	0.99									
North Head, Wash.	6			0.16																0.11		
Oklahoma, Okla.	21	9:48 p. m.	D. N.	1.25	10:37 p. m.	11:10 p. m.	0.09	0.28	0.49	0.55	0.70	0.86	1.08	1.13								
Palestine, Tex.	29	11:40 p. m.	5:40 a. m.	4.06	12:05 a. m.	12:58 a. m.	0.05	0.07	0.13	0.21	0.49	0.74	0.88	1.02	1.21	1.41	1.49					
Omaha, Nebr.	28	10:08 p. m.	3:30 a. m.	3.27	10:10 p. m.	11:45 p. m.	T.	0.31	0.55	0.75	0.90	0.96	1.01	1.03	1.09	1.12	1.19	1.25	1.47	1.67		
Orinfield, Vt.	10	1:40 p. m.	8:50 p. m.	1.22	2:04 p. m.	2:50 p. m.	T.	0.04	0.06	0.08	0.31	0.43	0.55	0.60	0.64	0.67						
Parkersburg, W. Va.	25-26	9:35 p. m.	N. D.	0.81	10:05 p. m.	10:35 p. m.	0.01	0.05	0.13	0.22	0.30	0.55	0.66	0.67								
Pensacola, Fla.	3			0.27																0.45		
Philadelphia, Pa.	3-4			0.37																0.44		
Pittsburgh, Pa.	27			0.37																0.28		
Pocatello, Idaho.	26			0.13																0.13		
Portland, Me.	5-6			0.46																0.10		
Portland, Oreg.	6			0.24																0.12		
Urbana, Colo.	28			0.23																0.14		
Wilmington, N. C.	21																					

TABLE V.—Accumulated amounts of precipitation for each 5 minutes, etc.—Continued.

Stations.	Date,	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.														
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.	
San Diego, Cal.	1	2	3	4	5	6	7														0.08	
Sandusky, Ohio	25																					
San Francisco, Cal.	27	5:50 p. m.	9:10 p. m.	0.76	5:50 p. m.	6:15 p. m.	0.00	0.20	0.31	0.33	0.40	0.46	0.48	0.52								
Savannah, Ga.	26			0.50																	0.49	
Scranton, Pa.	21-22			0.35																	0.25	
Seattle, Wash.	21-22			0.46																	0.29	
Shreveport, La.	8			0.49																	0.48	
Spokane, Wash.	15			0.30																	0.29	
Springfield, Ill.	24	10:46 a. m.	4:10 p. m.	1.65	2:25 p. m.	2:43 p. m.	1.00	0.12	0.26	0.49	0.53											
Springfield, Mo.	30	8:19 a. m.	9:26 a. m.	0.84	8:30 a. m.	9:00 a. m.	0.03	0.05	0.13	0.25	0.38	0.53	0.68	0.73	0.76							
Tampa, Fla.	12	5:50 p. m.	7:45 p. m.	0.71	6:00 p. m.	6:33 p. m.	T.	0.05	0.10	0.14	0.23	0.42	0.62	0.63	0.66							
Taylor, Tex.	5			0.60																	0.28	
Toledo, Ohio	27			0.86																	0.40	
Topeka, Kan.	29	3:28 p. m.	3:30 p. m.	0.78	4:05 p. m.	4:31 p. m.	0.09	0.09	0.27	0.42	0.54	0.64	0.67									
Valentine, Nebr.	25			0.50																	0.49	
Vicksburg, Miss.	8			0.89																	0.45	
Washington, D. C.	3	6:45 p. m.	8:30 p. m.	0.54	7:40 p. m.	8:04 p. m.	T.	0.07	0.24	0.30	0.45	0.51	0.54									
Wichita, Kans.	20-21	9:45 p. m.	9:30 a. m.	2.22	9:47 p. m.	10:50 p. m.	T.	0.18	0.33	0.45	0.68	1.02	1.22	1.28	1.34	1.44	1.57	1.67				
Wilmington, N. C.	22	9:13 p. m.	11:05 p. m.	1.07	10:15 p. m.	10:40 p. m.	0.19	0.05	0.23	0.54	0.67	0.76	0.80									
Wytheville, Va.	31	11:02 a. m.	11:27 a. m.	0.79	11:02 a. m.	11:17 a. m.	0.00	0.19	0.51	0.75	0.78	0.79									0.77	
Yankton, S. Dak.	9-10			1.69																		
Bridgetown, Barbados.	21			0.58																	0.39	
Havanas, Cuba	13	1:43 a. m.	5:30 a. m.	1.38	3:05 a. m.	4:05 a. m.	0.25	0.06	0.13	0.20	0.23	0.26	0.30	0.38	0.53	0.68	0.77	0.99				
San Juan, Porto Rico	20	12:26 p. m.	9:30 p. m.	1.72	4:45 p. m.	5:30 p. m.	0.79	0.10	0.18	0.29	0.35	0.42	0.47	0.51	0.65							

* Self-register not working.

TABLE VI.—Data furnished by the Canadian Meteorological Service, May, 1903.

Stations.	Pressure, in inches.				Temperature.				Precipitation.				Stations.	Pressure, in inches.				Temperature.				Stations.	Precipitation.			
	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Total.	Departure from normal.	Depth of snow.						
St. Johns, N. F.	Ins.	Ins.	Ins.	o	o	o	o	Ins.	Ins.	Ins.	Parry Sound, Ont.	Ins.	Ins.	o	o	o	o	Ins.	Ins.	Ins.	o	o	o	o		
Sydney, C. B. I.	30.09	30.13	+16	45.7	+0.5	55.2	36.2	1.66	-2.11		Port Arthur, Ont.	29.40	30.09	+14	55.3	+4.2	67.6	43.1	2.75	-0.18						
Halifax, N. S.	30.03	30.14	+16	50.9	+2.5	61.5	40.3	0.67	-3.59		Winnipeg, Man.	29.09	29.92	-04	54.2	+2.6	67.8	40.6	3.40	+1.12						
Grand Manan, N. B.	30.04	30.09	+12	49.7	+1.8	57.9	41.5	4.99	+1.38		Minnedosa, Man.	28.09	29.90	-06	51.4	+3.0	64.4	38.4	4.65	+3.20						
Yarmouth, N. S.	30.07	30.14	+16	48.7	+1.1	56.9	40.6	0.93	-2.87		Qu'Appelle, Assin.	27.59	29.83	-11	50.0	+0.2	62.3	37.8	3.86	+2.21	1.2					
Charlottetown, P. E. I.	30.07	30.11	+15	45.2	+0.3	56.6	37.7	0.83	-2.08	0.8	Medicine Hat, Assin.	27.58	29.85	-04	52.4	-1.7	65.3	39.5	4.19	+2.88	5.5					
Chatham, N. B.	30.05	30.08	+13	50.2	+1.7	62.8	37.6	1.37	-1.84		Swift Current, Assin.	27.31	29.87	-05	49.3	-1.4	61.7	36.9	3.23	+1.47	12.4					
Father Point, Que.	30.05	30.08	+15	45.8	+1.8	55.0	36.5	0.76	-1.31		Calgary, Alberta	26.30	29.82	-06	46.1	-2.9	62.8	35.5	4.25	+2.48	31.9					
Quebec, Que.	29.77	30.10	+16	53.1	+3.2	64.5	41.7	0.76	-2.32		Banff, Alberta	25.29	29.88	-00	43.0	-4.0	54.5	31.5	0.94	-1.10	6.1					
Montreal, Que.	29.89	30.09	+15	55.0	+3.3	69.9	46.2	0.11	-2.84		Edmonton, Alberta	27.54	29.81	-07	49.2	-1.6	62.8	35.5	1.21	-0.34	5.7					
Bissett, Ont.	29.51	30.12	+19	53.7	+1.4	70.6	36.9	1.99	-0.52		Prince Albert, Sask.	28.28	29.84	-11	47.2	-0.4	61.6	32.8	2.08	+0.82	2.1					
Ottawa, Ont.	29.83	30.15	+21	50.2	+4.3	72.9	45.4	0.12	-2.47	T.	Battleford, Sask.	28.13	29.85	-07	49.9	-1.1	63.0	36.7	3.70	+2.08	3.1					
Kingston, Ont.	29.80	30.11	+15	55.9	+3.0	63.3	45.5	0.52	-2.16		Kamloops, B. C.															
Toronto, Ont.	29.74	30.11	+13	55.9	+2.7	66.7	65.6	0.52	-1.24	0.1	Victoria, B. C.	29.95	30.05	+05	51.6	-0.9	57.9	45.3	0.79	-0.69						
White River, Ont.	28.83	30.15	+20	47.0	+1.3	60.3	33.7	4.96	+3.01	0.1	Barkerville, B. C.	25.62	29.91	+07	43.3	-2.2	55.2	31.5	2.78	+0.26	5.0					
Port Stanley, Ont.	29.46	30.10	+13	50.6	+2.9	65.8	46.3	3.27	+0.09	T.	Hamilton, Bermuda.	29.89	30.05	-01	68.2	-1.2	73.1	63.4	3.98	-0.68						
Saugeen, Ont.	29.40	30.11	+15	55.8	+5.1	66.7	44.8	1.73	-0.71	0.2	Dawson City, Yukon...															

TABLE VII.—Heights of rivers referred to zeros of gages, May, 1903.

Stations.	Highest water.				Lowest water.				Stations.	Highest water.				Lowest water.	
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TABLE VII.—Heights of rivers referred to zeros of gages—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
<i>Allegheny River.</i>	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>			<i>Red River</i> —Continued.	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>		<i>Feet.</i>	<i>Feet.</i>		
Warren, Pa.	177	14	1.2	1	0.5	25-28	0.7	0.7	Shreveport, La.	327	29	13.2	26	3.8	11	6.8	9.4
Oil City, Pa.	123	13	1.8	1	0.8	18-20, 26, 27	1.2	1.0	Alexandria, La.	118	33	16.3	30	11.0	26, 26	12.8	5.3
Parker, Pa.	73	20	1.6	1, 6	0.7	21-23	1.1	0.9	<i>Ouachita River.</i>								
Freeport, Pa.	29	20	4.0	1	1.6	22, 23	2.6	2.4	Camden, Ark.	304	39	33.0	13, 14	6.5	6	19.8	26.5
<i>Clarion River.</i>									Monroe, La.	122	40	34.3	1	28.8	31	30.9	5.5
Clarion, Pa.	32	10	1.9	5	0.2	22, 23	0.8	1.7	<i>Atchafalaya River.</i>								
<i>Monongahela River.</i>									Melville, La.	100	31	36.8	1	31.0	31	34.6	5.8
Weston, W. Va.	161	18	9.5	26	0.0	21	2.7	9.5	<i>Susquehanna River.</i>								
Fairmont, W. Va.	119	25	10.5	27	1.0	21-23	2.6	9.5	Binghamton, N. Y.	306	16	3.2	1	2.7	25-28, 30, 31	2.9	0.5
Greensboro, Pa.	81	18	12.7	27	6.7	21-23	7.7	6.0	Towanda, Pa.	262	16	1.5	1	0.5	26-31	0.9	1.0
Lock No. 4, Pa.	40	28	14.5	28	6.2	15	8.0	8.3	Wilkesbarre, Pa.	183	17	4.8	1	3.0	23-31	3.6	1.8
<i>Coneimaugh River.</i>									Harrisburg, Pa.	69	17	3.2	1	1.2	29-31	1.9	2.0
Johnstown, Pa.	64	7	2.5	1	1.0	22, 23	1.9	1.5	<i>West Branch Susquehanna.</i>								
<i>Red Bank Creek.</i>									Lock Haven, Pa.	65	12	0.5	1	—	27, 28	0.3	1.0
Brookville, Pa.	35	8	0.4	1-10	—0.2	26-31	1.0	0.6	Williamsport, Pa.	39	20	2.4	1	0.9	25, 26	1.4	1.5
<i>Beaver River.</i>									<i>Juniata River.</i>								
Ellwood Junction, Pa.	10	14	3.0	1	2.4	19-22	2.8	0.6	Huntingdon, Pa.	90	24	3.8	1, 4, 25	3.3	21-23	3.5	0.5
<i>Great Kanawha River.</i>									<i>Shenandoah River.</i>								
Charleston, W. Va.	58	30	7.4	{22, 23, 25}	4.1	20	5.9	3.3	Riverton, Va.	58	22	1.2	1	0.3	29	0.6	0.9
<i>Little Kanawha River.</i>				{29, 30}					<i>Potomac River.</i>								
Glenville, W. Va.	103	20	6.0	26	—2.7	19-22	0.1	8.7	Cumberland, Md.	290	8	3.2	{1, 2, 8, 9, } {26, 27}	2.5	21	2.9	0.7
<i>New River.</i>									Harpers Ferry, W. Va.	172	18	3.4	1	0.3	25	1.8	3.1
Radford, Va.	155	14	1.8	1	0.0	27-31	0.8	1.8	<i>James River.</i>								
Hinton, W. Va.	95	14	3.7	1	1.9	26-28	2.5	1.8	Lynchburg, Va.	260	18	2.7	1	1.0	20-28	1.5	1.7
<i>Cheat River.</i>									Richmond, Va.	111	12	2.0	1	—0.2	21-23	0.6	2.2
Bowlesburg, W. Va.	36	14	5.4	27	1.3	22	2.4	4.1	<i>Dan River.</i>								
<i>Ohio River.</i>									Danville, Va.	55	8	1.9	29	—0.2	23, 24	0.3	2.1
Pittsburg, Pa.	966	22	7.3	28	2.8	2	5.5	4.5	<i>Roanoke River.</i>								
Davis Island Dam, Pa.	960	25	7.0	28	2.7	19-22	4.1	4.3	Clarksville, Va.	196	12	6.5	1	3.9	22, 23	4.6	2.6
Beaver Dam, Pa.	925	27	8.8	29	3.1	19, 20	5.0	5.7	Weldon, N. C.	129	30	16.1	1	10.6	24	11.7	5.5
Wheeling, W. Va.	875	36	8.1	29	2.7	21, 22	4.7	5.4	<i>Cape Fear River.</i>								
Parkersburg, W. Va.	785	36	8.5	31	3.5	22, 23	6.1	5.0	Fayetteville, N. C.	112	38	14.7	1	3.7	24	5.7	11.0
Point Pleasant, W. Va.	705	39	11.2	1	2.6	22	5.7	8.6	<i>Edisto River.</i>								
Huntington, W. Va.	660	50	16.7	1	5.6	22	9.4	11.1	Edisto, S. C.	75	6	5.0	9	3.4	30, 31	4.0	1.6
Catlettsburg, Ky.	651	50	16.9	1	4.6	22	8.2	12.3	<i>Pedee River.</i>								
Portsmouth, Ohio.	612	50	18.7	1	5.9	25	9.8	12.8	Cheraw, S. C.	149	27	6.8	1	2.8	27	4.8	4.0
Cincinnati, Ohio.	499	50	23.0	1	7.6	25	12.0	15.4	<i>Black River.</i>								
Madison, Ind.	413	46	20.7	1	7.4	26	11.5	13.3	Kingstree, S. C.	52	12	7.5	1	1.6	29-31	5.0	5.9
Louisville, Ky.	367	28	9.0	1, 2	4.3	26-28	6.1	4.7	Effingham, S. C.	35	12	6.2	5	4.0	26-31	4.6	2.2
Evansville, Ind.	184	35	20.9	1	6.4	29	10.8	14.5	<i>Santee River.</i>								
Paducah, Ky.	47	40	28.3	1	9.1	26	13.7	19.2	St. Stephens, S. C.	97	12	8.5	1	4.8	29, 30	7.0	3.7
Cairo, Ill.	1,073	45	38.0	1	20.7	17	25.1	17.3	<i>Congaree River.</i>								
<i>Muskingum River.</i>									Columbia, S. C.	37	15	3.2	29	1.3	26	2.0	1.9
Zanesville, Ohio.	70	20	7.7	1	6.1	20-22	6.8	1.6	<i>Watauga River.</i>								
<i>Scioto River.</i>									Camden, S. C.	45	24	9.7	31	5.9	28	7.9	3.8
Columbus, Ohio.	110	17	3.2	1-13	1.6	22, 23	2.8	1.6	<i>Waccamaw River.</i>								
<i>Miami River.</i>									Conway, S. C.	40	7	4.5	11	2.0	23	3.4	2.5
Dayton, Ohio.	77	18	2.7	28	1.4	19-21	1.8	1.3	<i>Savannah River.</i>								
<i>Wabash River.</i>									Calhoun Falls, S. C.	347	15	4.0	4	3.0	26, 27	3.4	1.0
Mount Carmel, Ill.	50	15	8.3	1	3.3	23	5.1	5.0	Broad River.	268	32	12.8	16	8.8	26, 27	10.2	4.0
<i>Licking River.</i>									Carlton, Ga.	30	11	4.0	31	2.8	26, 27, 29	3.1	1.2
Falmouth, Ky.	30	25	3.0	1-6	1.2	27	2.2	1.8	<i>Flint River.</i>								
<i>Kentucky River.</i>									Albany, Ga.	80	20	16.9	18	4.0	7	9.2	12.9
High Bridge, Ky.	117	17	11.2	3	9.2	26-30	9.9	2.0	<i>Chattahoochee River.</i>								
Frankfort, Ky.	65	31	8.3	1	5.9	29, 30	6.6	2.4	Oakdale, Ga.	305	18	5.0	5, 27, 28	2.3	16	4.1	2.7
<i>Cinch River.</i>									Westpoint, Ga.	239	20	12.7	15	3.6	26-30	4.9	9.1
Speers Ferry, Va.	156	20	1.8	1	—0.3	26, 27	0.3	2.1	<i>Ocmulgee River.</i>								
Clinton, Tenn.	52	25	8.5	1	3.4	28, 29	5.1	5.1	Macon, Ga.	125	18	11.0	16	4.2	27	5.7	6.8
<i>Holston River.</i>									Dublin, Ga.	79	20	11.5	19	2.3	27, 28	4.9	9.2
Rogersville, Tenn.	103	14	3.7	1	1.9	28, 29	2.5	1.8	<i>Oconee River.</i>								
<i>French Broad River.</i>									Rome, Ga.	271	30	6.7	31	2.0	28, 29	3.1	4.7
Asheville, N. C.	144	6	1.6	30	0.3	21, 22	0.7	1.3	Gadsden, Ga.	144	18	6.5	16	1.7	29	3.4	4.8
Leadville, Tenn.	70	15	2.0	4	—1.8	5	0.1	3.8	<i>Alabama River.</i>								
<i>Tennessee River.</i>									Montgomery, Ala.	265	35	28.5	17	4.8	29, 30	9.5	23.7
Knoxville, Tenn.	635	29	5.0	1	1.7	28	2.8	3.3	Selma, Ala.	212	35	31.2	18	6.4	29	12.6	24.8
Kingston, Tenn.	556	25	5.4	1	2.0	27,											

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITIER, Director, Physico-Geographic Institute.

TABLE 1.—Hourly observations at the Observatory, San José de Costa Rica, during May, 1903.

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		Duration, 1903.
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	
1 a. m.	26.16	26.14	63.9	64.4	92	91	0.05	0.03	2.33
2 a. m.	26.12	26.13	63.5	64.0	92	91	T.	0.03	0.67
3 a. m.	26.13	26.11	63.3	63.7	90	91	0.04	0.05	1.50
4 a. m.	26.11	26.11	63.0	63.3	89	90	0.02	0.02	1.00
5 a. m.	26.12	26.11	62.4	63.1	91	90	0.03	0.02	1.00
6 a. m.	26.15	26.11	62.4	62.8	90	90	0.01	0.03	1.00
7 a. m.	26.14	26.13	62.8	63.3	89	89	0.00	0.01	0.00
8 a. m.	26.15	26.14	66.6	68.7	77	80	0.00	0.02	0.00
9 a. m.	26.16	26.15	70.9	70.9	70	74	0.00	0.02	0.00
10 a. m.	26.17	26.16	74.7	74.7	65	67	0.03	T.	0.17
11 a. m.	26.16	26.15	77.0	76.5	58	63	0.00	0.02	0.00
Noon	26.15	26.14	78.4	78.1	57	64	0.00	0.06	0.00
1 p. m.	26.13	26.12	78.8	78.4	61	62	0.00	0.18	0.00
2 p. m.	26.11	26.10	77.9	77.5	65	65	0.00	0.73	0.00
3 p. m.	26.10	26.09	75.2	74.9	69	71	0.38	0.85	1.84
4 p. m.	26.09	26.08	72.0	72.7	78	76	2.42	1.59	8.26
5 p. m.	26.10	26.09	69.8	70.3	82	80	1.99	1.43	12.35
6 p. m.	26.11	26.10	68.0	69.0	88	85	3.03	1.35	14.55
7 p. m.	26.15	26.12	66.9	67.5	91	87	1.89	1.06	13.34
8 p. m.	26.14	26.13	66.2	66.6	90	89	1.63	0.79	9.61
9 p. m.	26.16	26.15	65.8	66.2	91	90	1.62	0.46	9.49
10 p. m.	26.17	26.16	65.5	65.6	91	90	0.60	0.22	8.25
11 p. m.	26.18	26.16	64.9	64.9	92	91	0.33	0.13	6.49
Midnight	26.17	26.16	64.4	64.9	93	91	0.33	0.06	4.50
Mean	26.14	26.13	68.4	68.8	81	82	—	—	—
Minimum	26.04	25.98	56.5	53.4	40	—	—	—	—
Maximum	26.23	26.24	85.5	90.5	100	—	—	—	—
Total	192.57	165.28	—	—	—	14.60	9.15	96.35	—

REMARKS.—At San José the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds in advance of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limón the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—San José, May, 1903.

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				—
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	6 inches.	12 inches.	24 inches.	48 inches.	
7 a. m.	15.68	12.61	58	58	72.2	72.9	73.8	72.7	71.4
8 a. m.	23.24	19.43	—	—	—	—	—	—	—
9 a. m.	25.47	20.97	—	—	—	—	—	—	—
10 a. m.	25.58	21.52	67	64	72.5	72.9	73.9	72.7	—
11 a. m.	25.75	19.91	—	—	—	—	—	—	—
Noon	21.70	16.85	—	—	—	—	—	—	—
1 p. m.	17.91	15.27	76	77	78.5	73.2	73.7	72.7	—
2 p. m.	15.37	14.21	—	—	—	—	—	—	—
3 p. m.	9.61	10.72	—	—	—	—	—	—	—
4 p. m.	6.79	7.01	80	89	73.9	73.5	73.8	72.6	—
5 p. m.	4.11	4.77	—	—	—	—	—	—	—
6 p. m.	1.41	2.01	—	—	—	—	—	—	—
7 p. m.	—	—	87	88	73.8	73.5	73.8	72.6	—
8 p. m.	—	—	—	—	—	—	—	—	—
9 p. m.	—	—	77	77	73.5	73.5	73.9	72.6	—
10 p. m.	—	—	—	—	—	—	—	—	—
11 p. m.	—	—	—	—	—	—	—	—	—
Midnight	—	—	—	—	—	—	—	—	—
Mean	77	76	78.2	73.2	73.9	72.6	71.4	—	—
Total	192.57	165.28	—	—	—	—	—	—	—

MONTHLY WEATHER REVIEW.

TABLE 3.—Rainfall at stations in Costa Rica, May, 1903.

Stations.	Height above sea level.	Observed, 1903.		Averages.	
		Amount.	Number of days.	Amount.	Number of days.
Sipurio (Talamanca)	197	7.36	15	8.12	18
Boca Banano	10	6.81	14	7.52	17
Port Limon	10	0.65	5	9.34	14
Swamp Mouth	10	2.60	15	7.64	13
Zent	66	2.91	15	6.81	13
Siquirres	197	1.22	8	10.83	16
Dos Novillos	400	8.89	17	—	—
Guapiles	984	8.34	7	11.89	18
Cariblanco (Sarapiquí)	2,740	—	—	17.44	21
San Carlos	328	10.23	16	11.62	18
Las Lomas	873	3.35	17	15.39	11
Peralta	1,089	12.16	17	14.41	20
Turrialba	2,034	0.12	4	8.11	19
Juan Viñas	3,412	4.45	17	8.50	10
Santiago	3,609	9.80	19	4.53	13
Paraiso	4,383	18.47	20	10.86	19
Cachi	3,346	10.86	20	6.46	17
Las Concavas	4,386	9.41	22	10.90	24
Cartago	4,265	12.09	20	7.29	14
Tres Ríos	18,03	18.03	22	12.44	17
San Francisco Guadalupe	3,894	11.53	23	8.15	17
San José	3,806	14.61	23	8.50	19
La Verbena	3,740	15.31	22	7.68	16
Nuestro Amo	2,595	24.09	20	8.15	17
Alajuela	3,117	20.78	23	15.08	19
San Isidro Alajuela	4,416	22.71	25	18.07	24

TABLE 4.—Observations taken at Port Limón and Zent, May, 1903.

Stations.	Pressure.			Temperature.			Relative humidity.
	Minim.	Max.	Mean.	Minim.	Max.	Mean.	
Port Limon	29.70	30.07	29.84	66.2	76.0	76.1	77
Zent	—	—	—	57.2	95.0	79.5	81
Stations.	Cloudiness.	Sunshine.	Rainfall.	Temperature of soil at depth of—			
Port Limon	—	—	Amount.	Number of days.	6 inches.	12 inches.	24 inches.
Zent	68	207.24	2.91	15	82.0	81.8	81.1

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

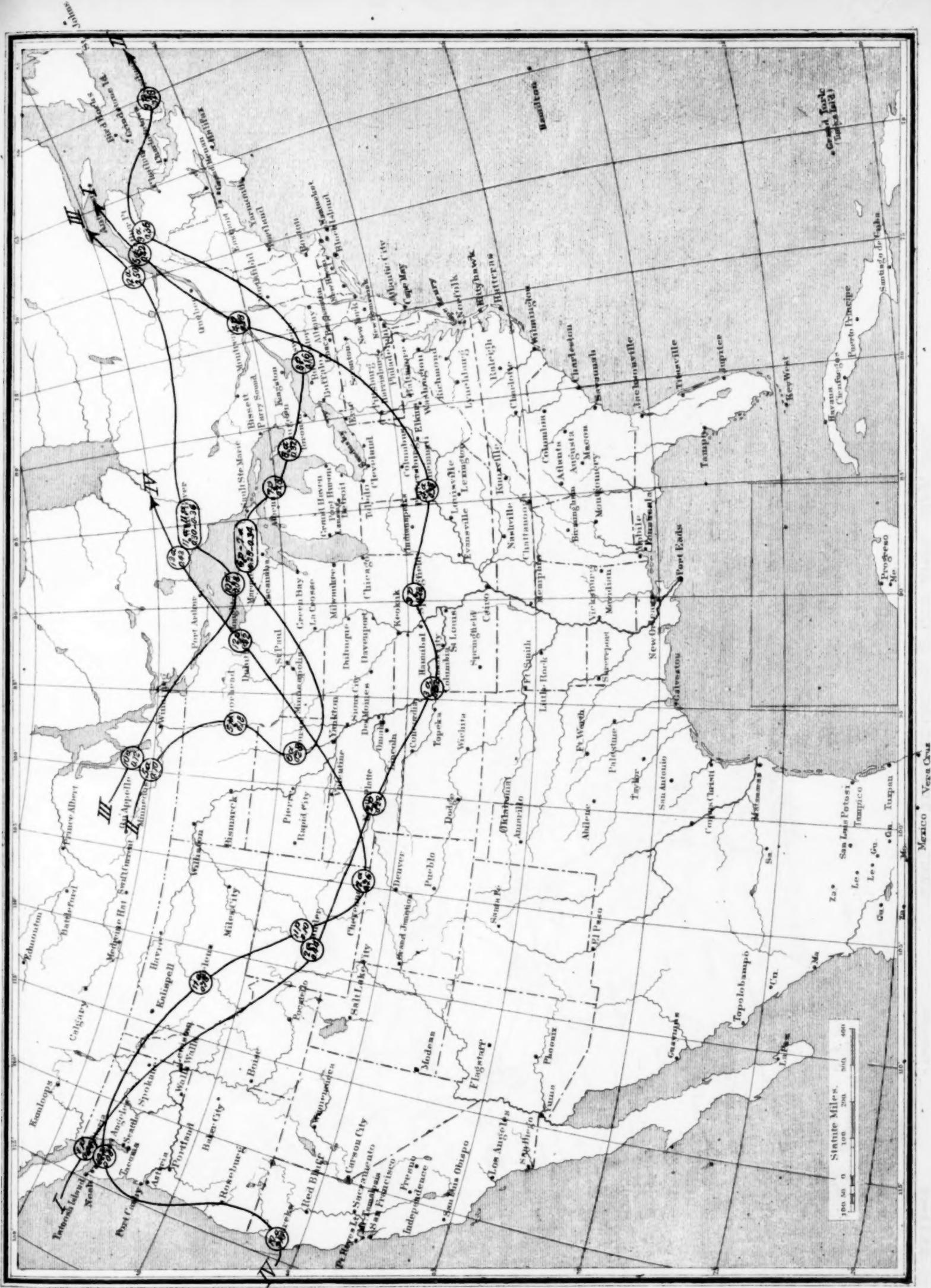
May, 1903.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.
			Max.	Min.	Mean.			
Chihuahua	4,684	25.15	93.2	51.8	73.6	26	0.32	sw.
Guadalajara (Obs. del. Est.)	5,186	24.88	95.4	55.4	73.2	43	0.11	sw.
Guanajuato	6,640	—	—	—	—	—	—	—
Leon (Guanajuato)	5,906	24.20	95.7	49.3				

Chart I. Tracks of Centers of High Areas. May, 1903.

Barkerville

XXXI-43.



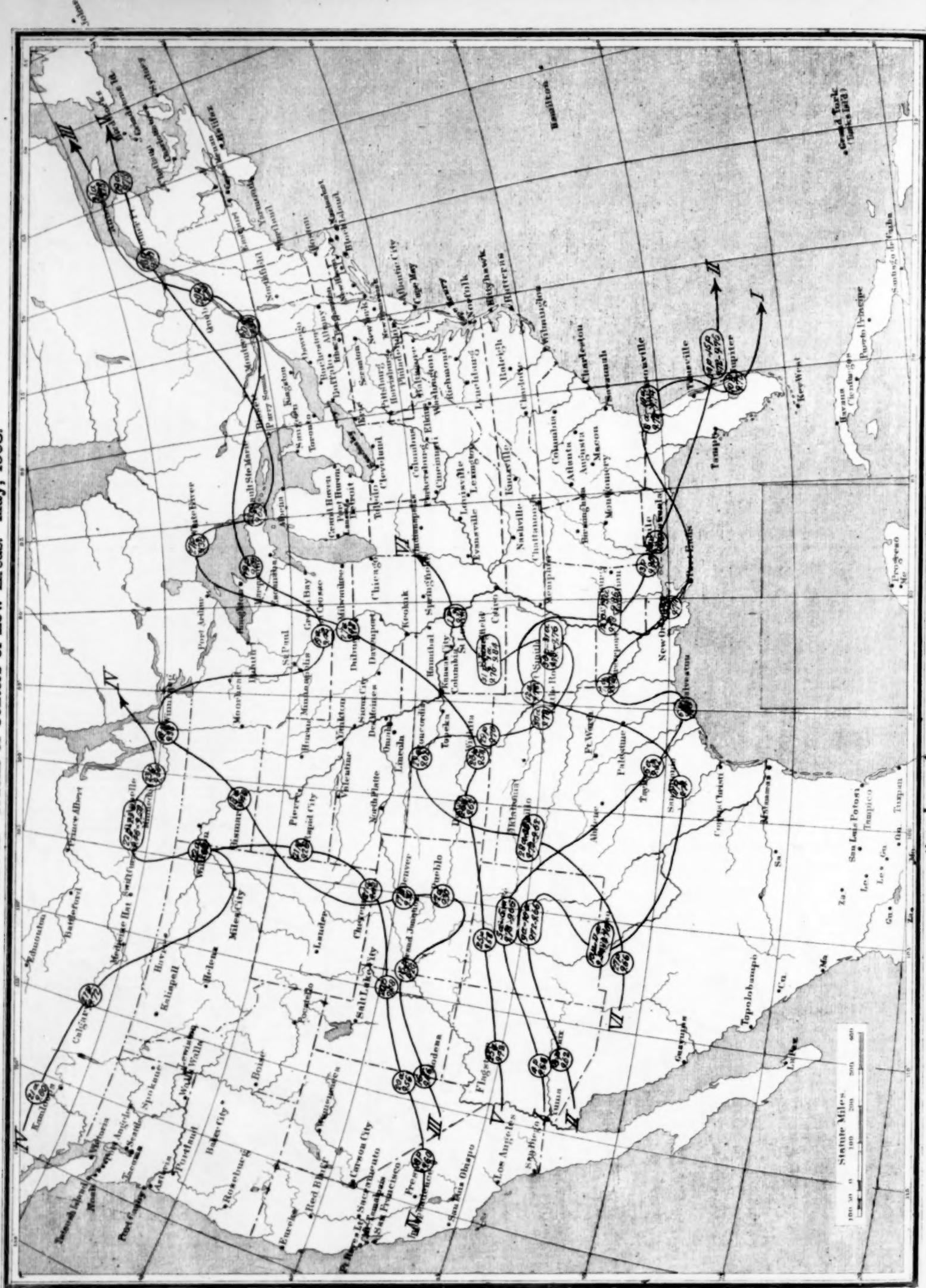


Chart III. Total Precipitation. May, 1903.

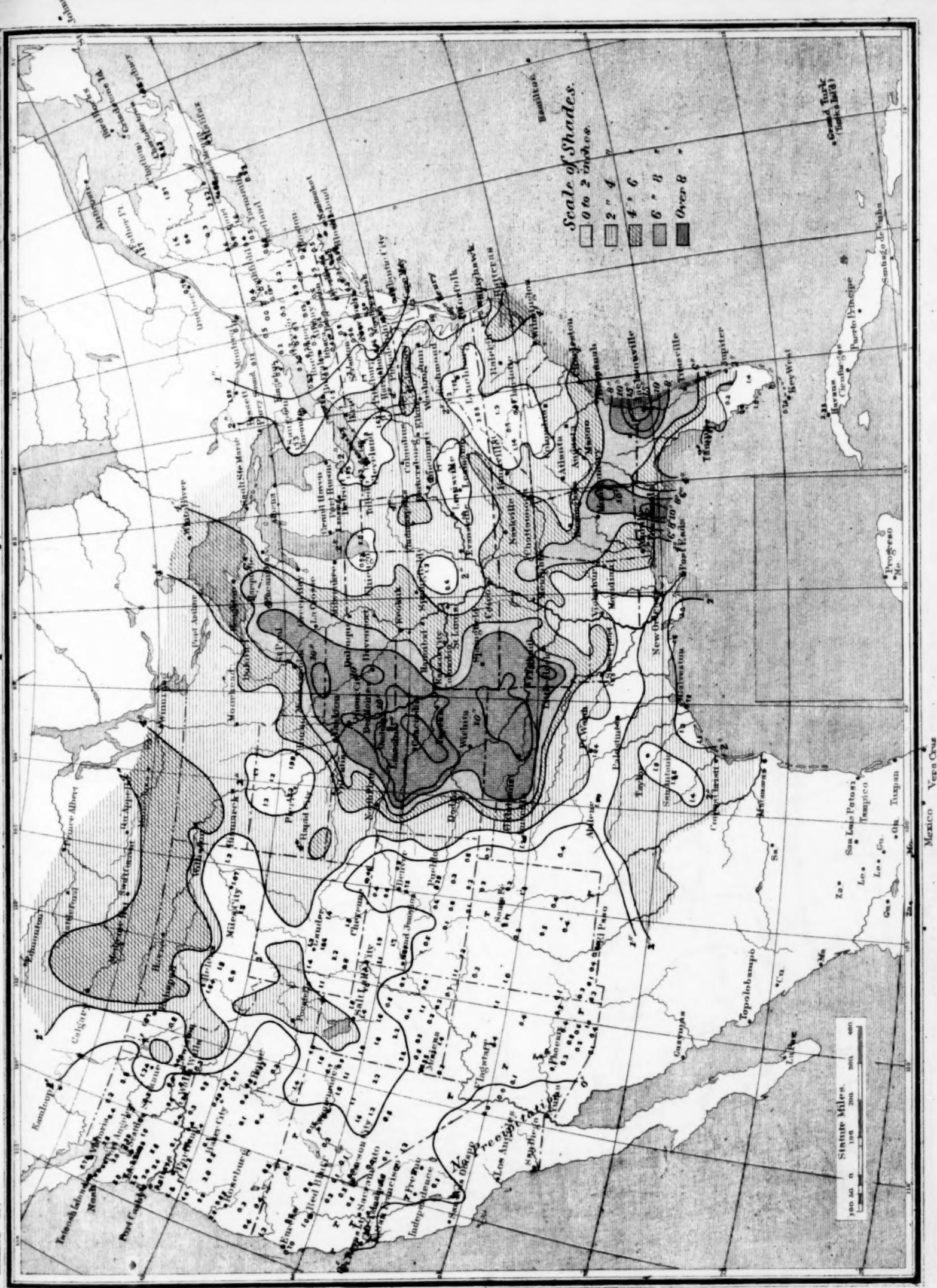
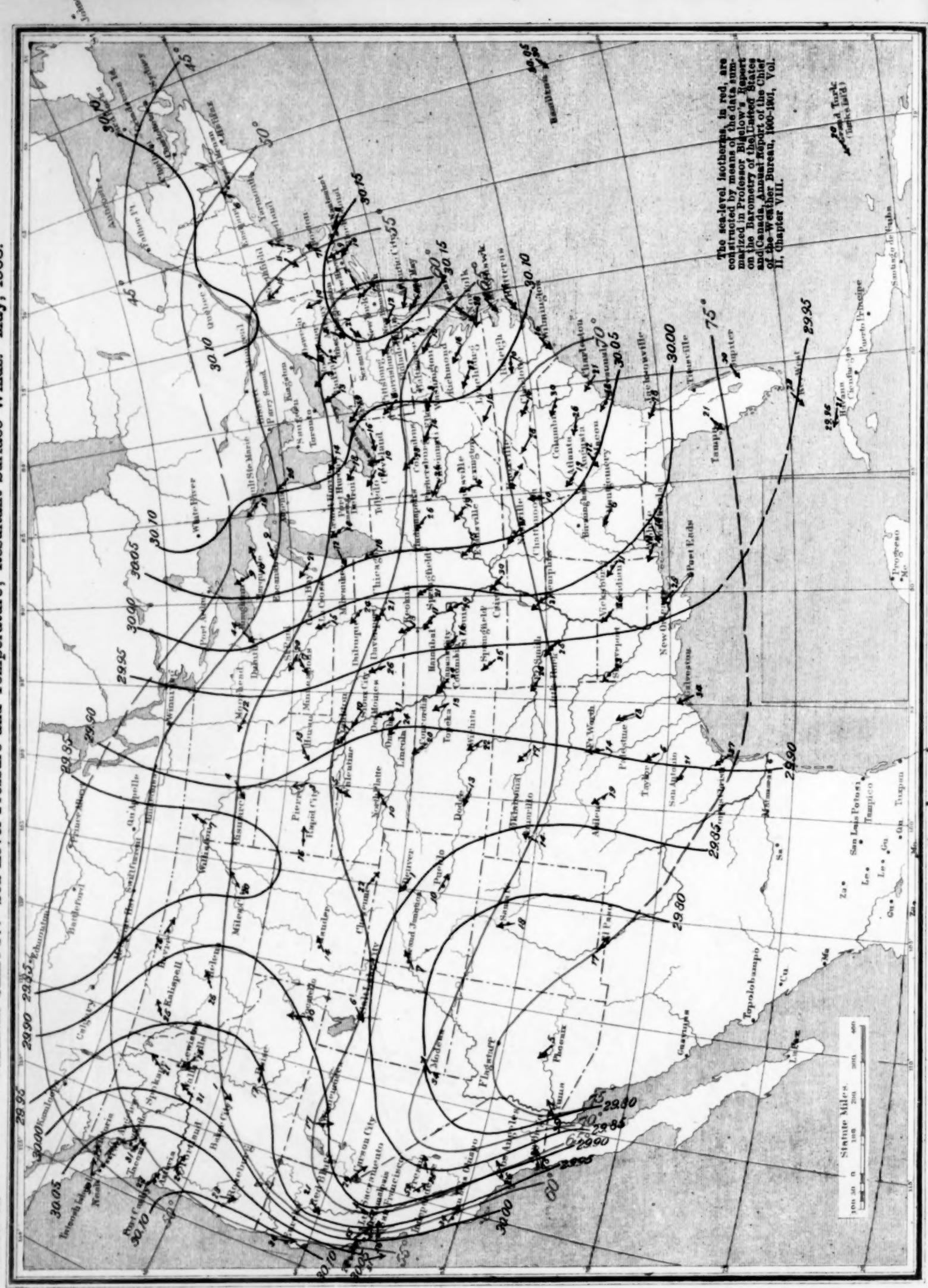


Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. May, 1903.



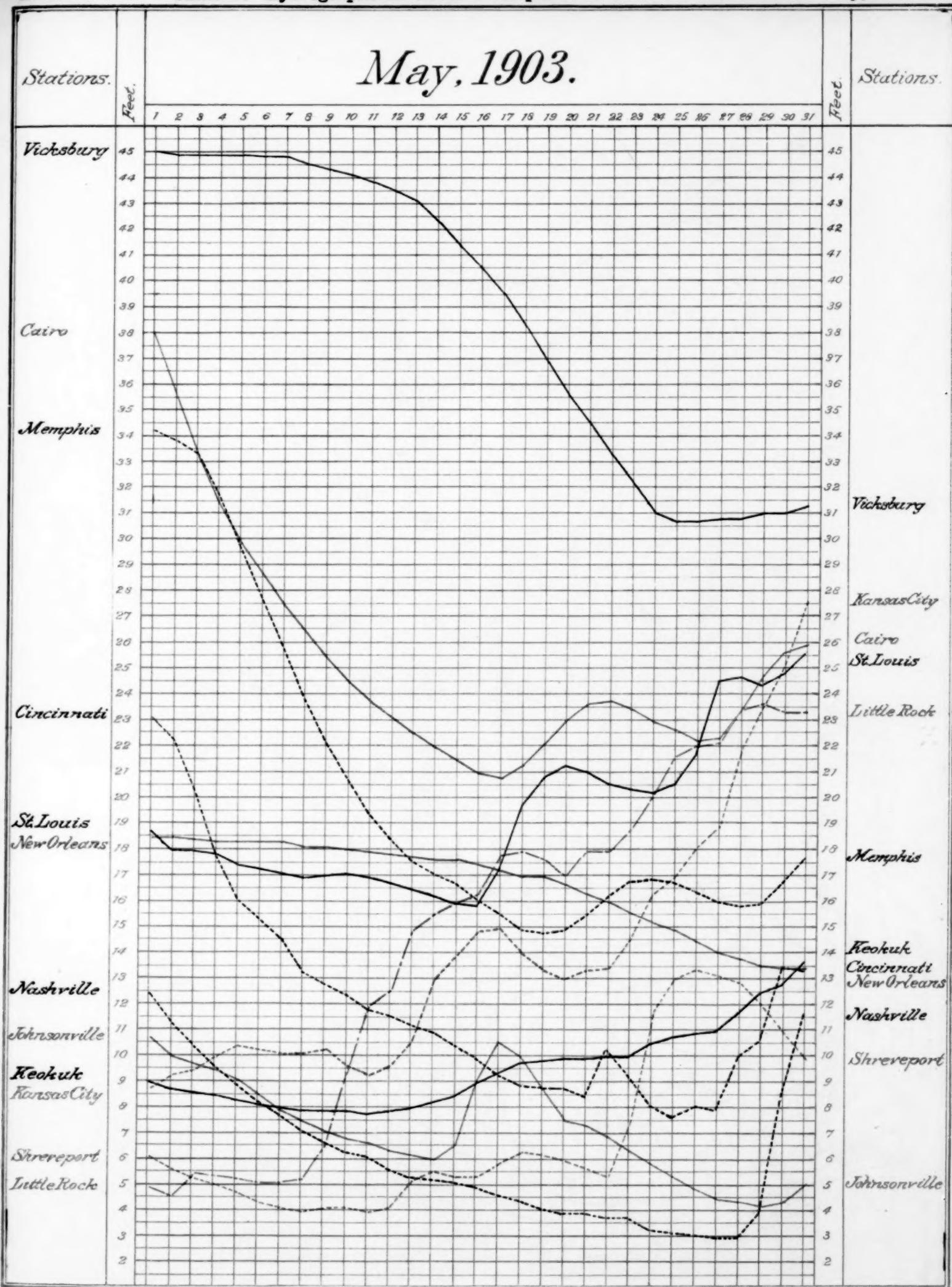


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. May, 1903.

• Barkerville

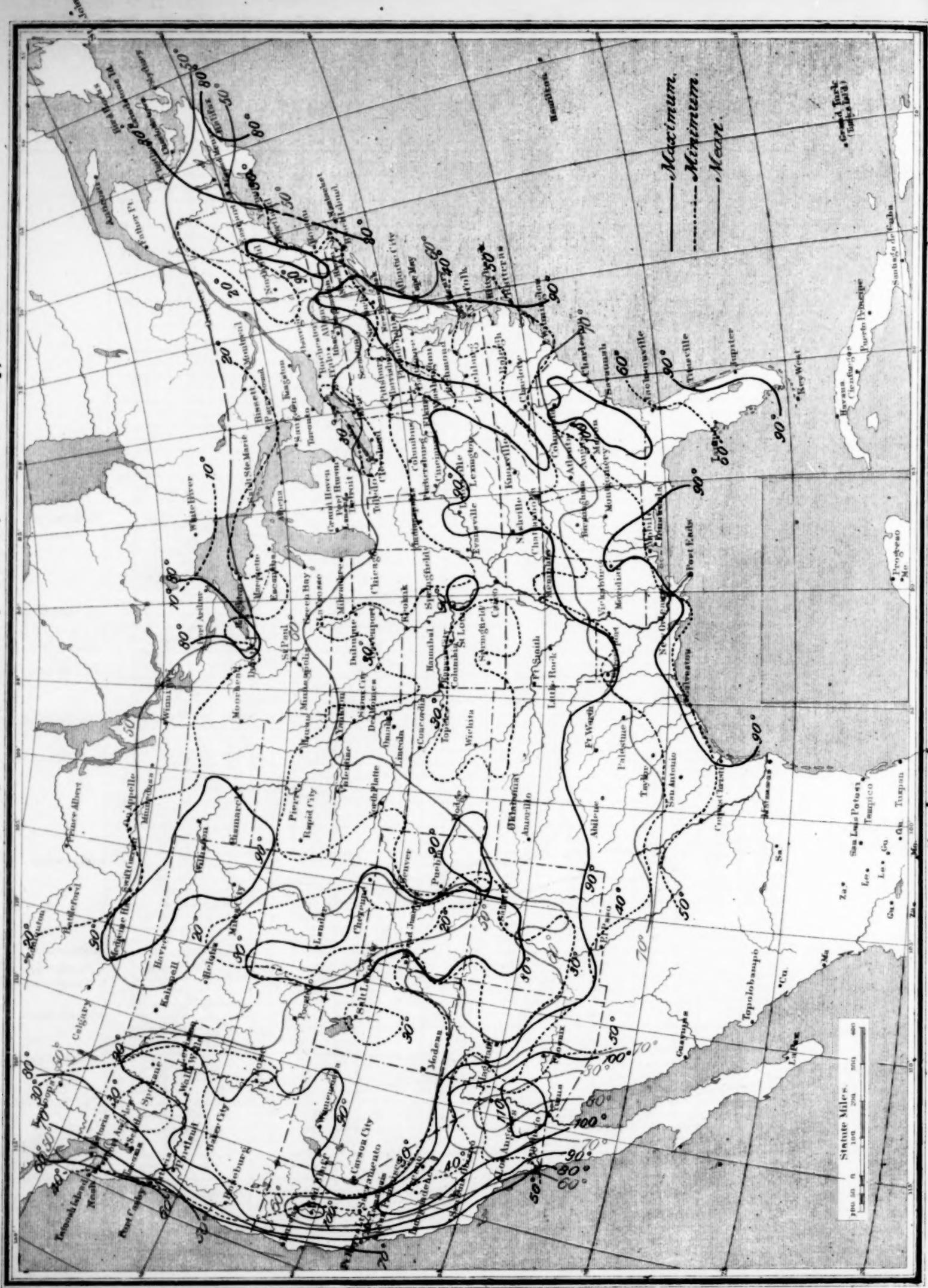


Chart VII. Percentage of Sunshine. May, 1903.

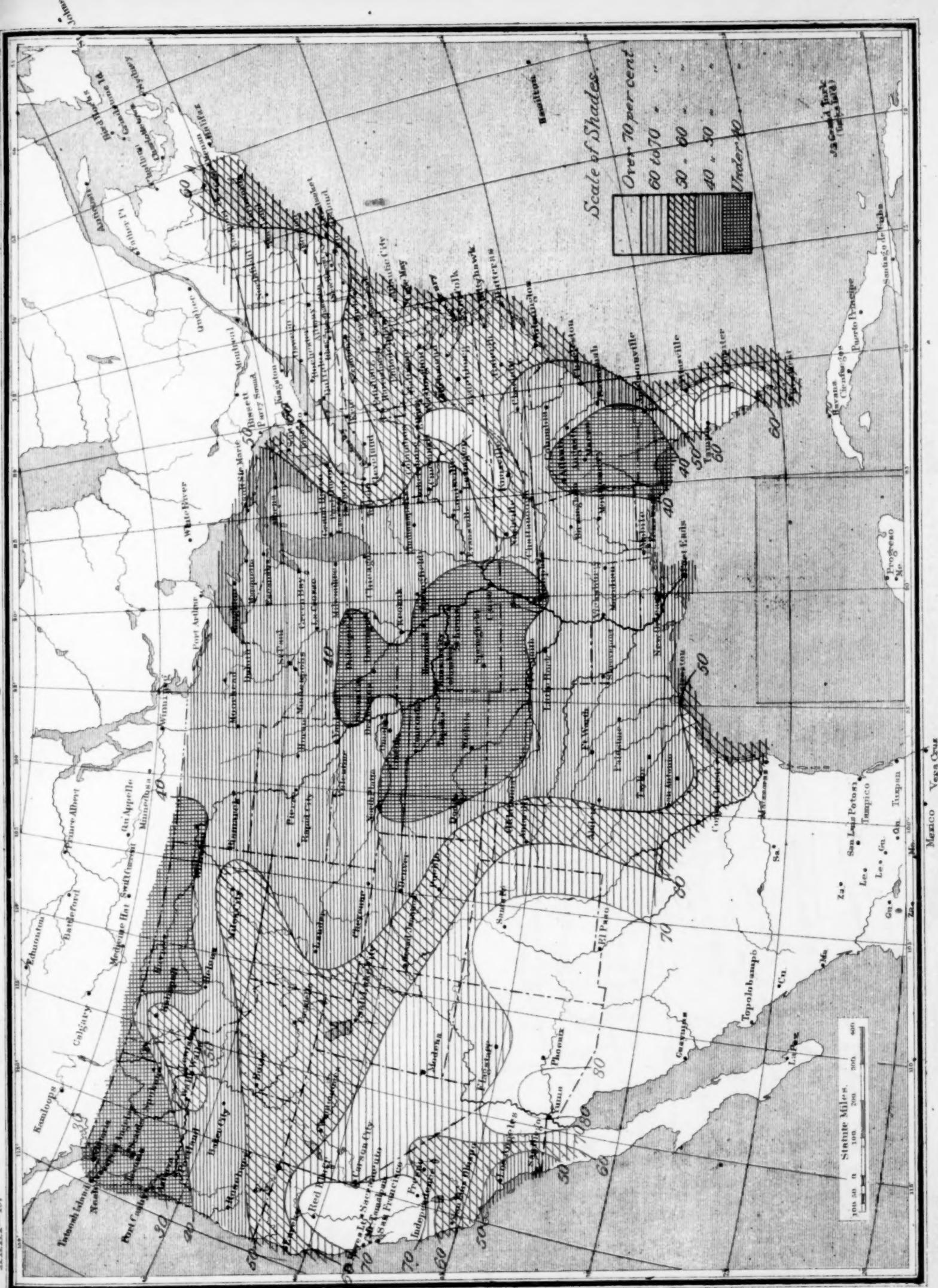
• Barkerville

XXXI—49.

Chart VII. Percentage of Sunshine. May, 1903.

Barkerville

XXXI-49.



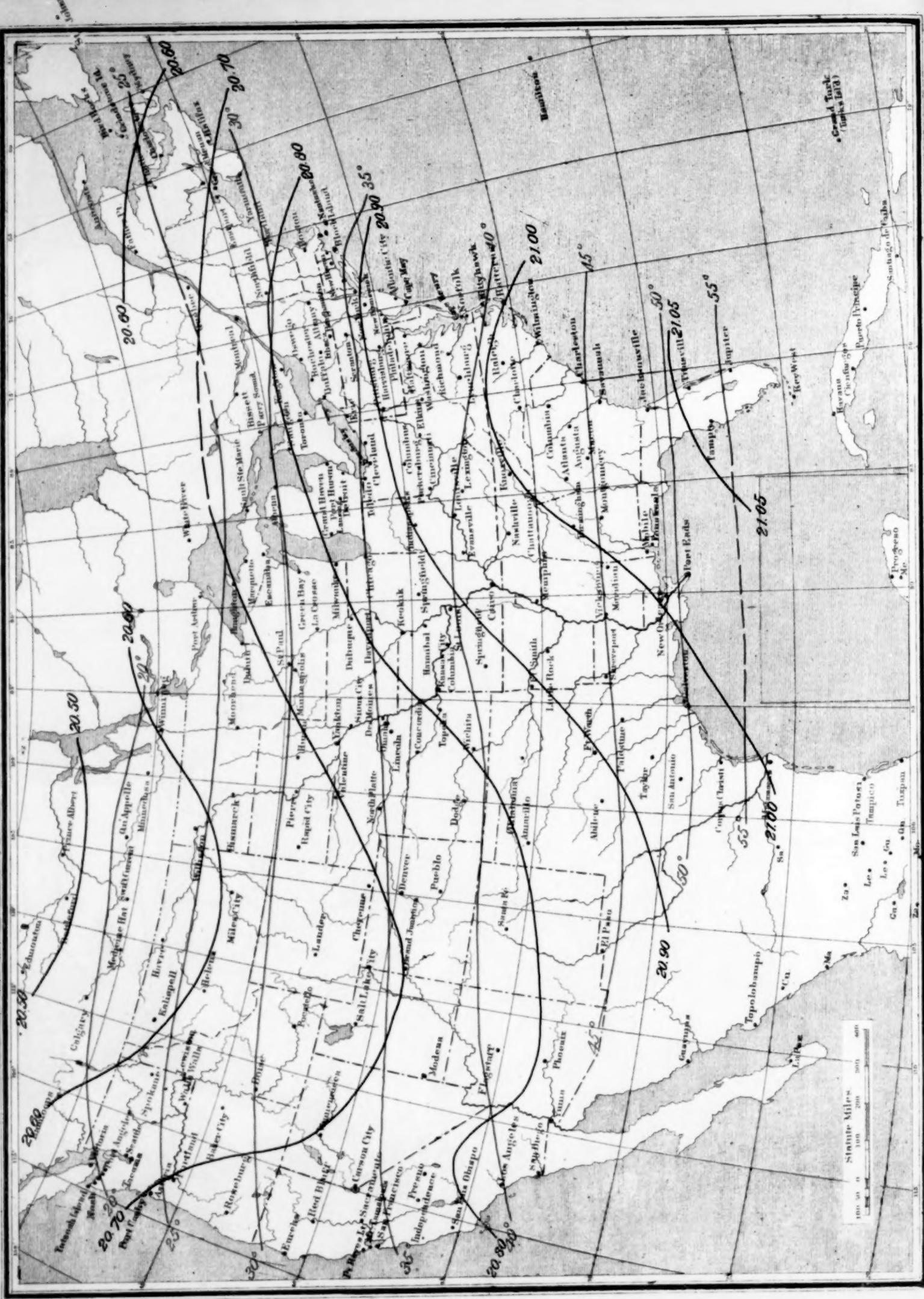
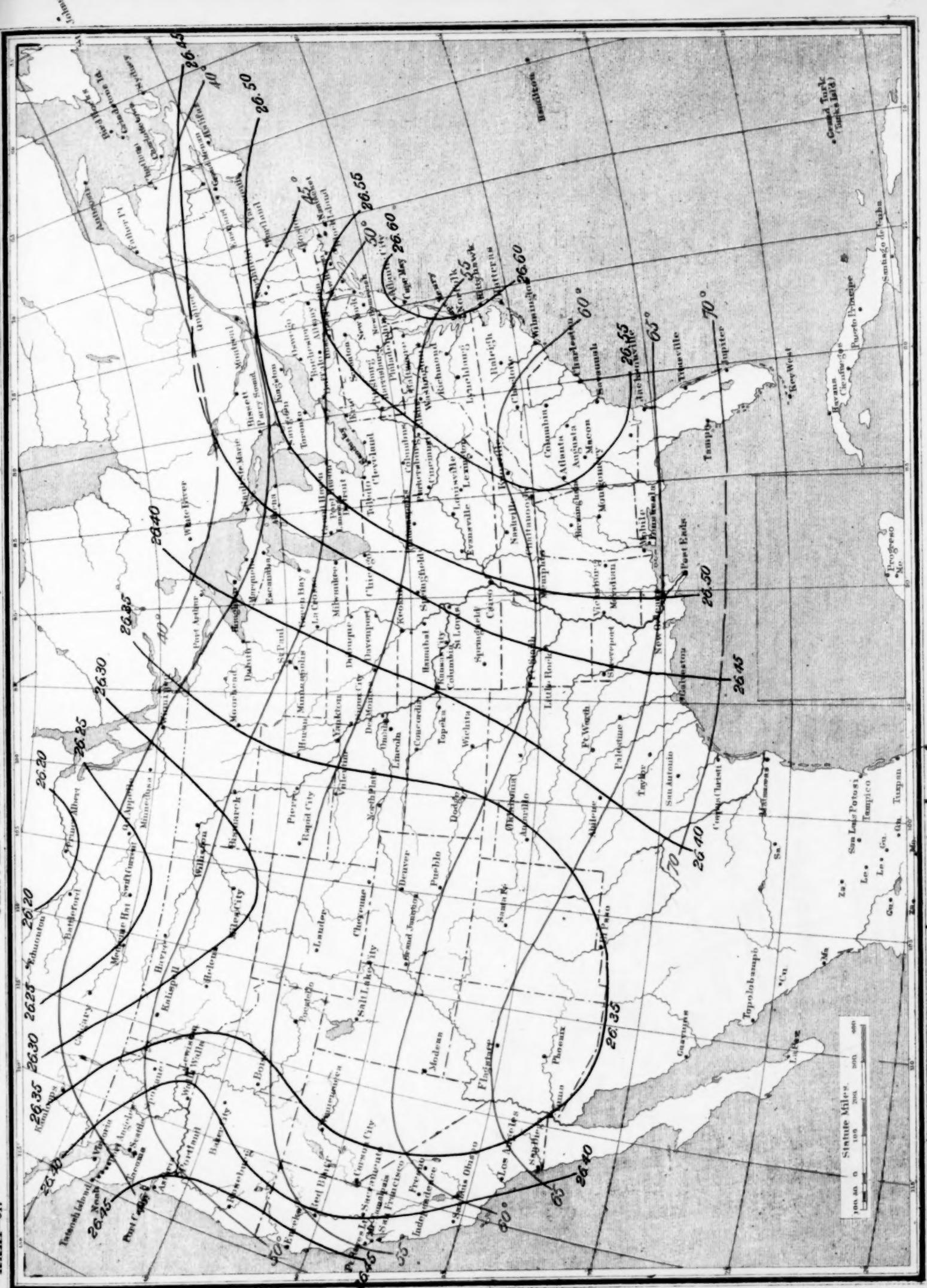


Chart IX Isohyps and Isotherms at 3,500 feet. May, 1903.



• Barkerville
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Chart X. Total Snowfall for May, 1903.

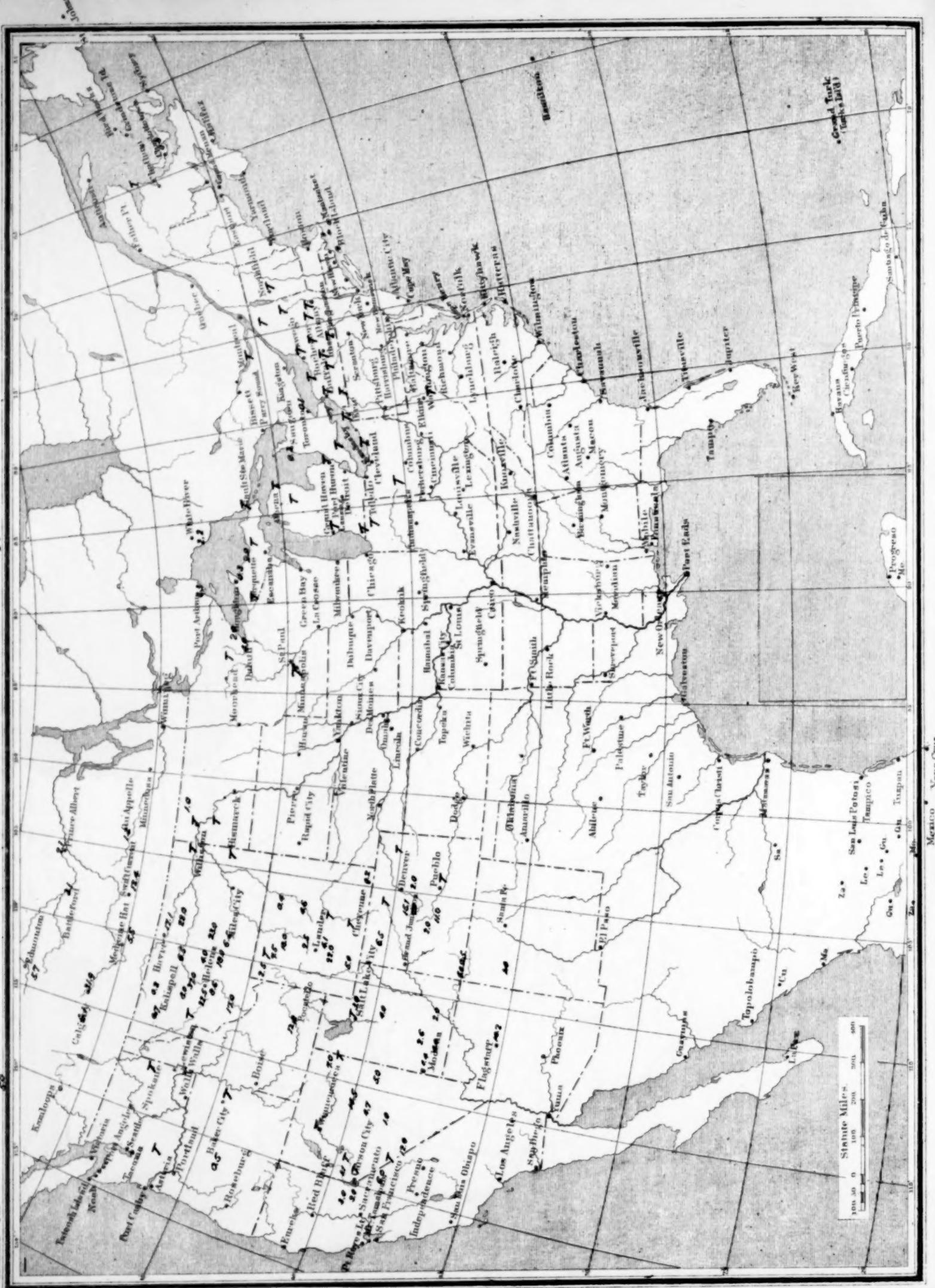
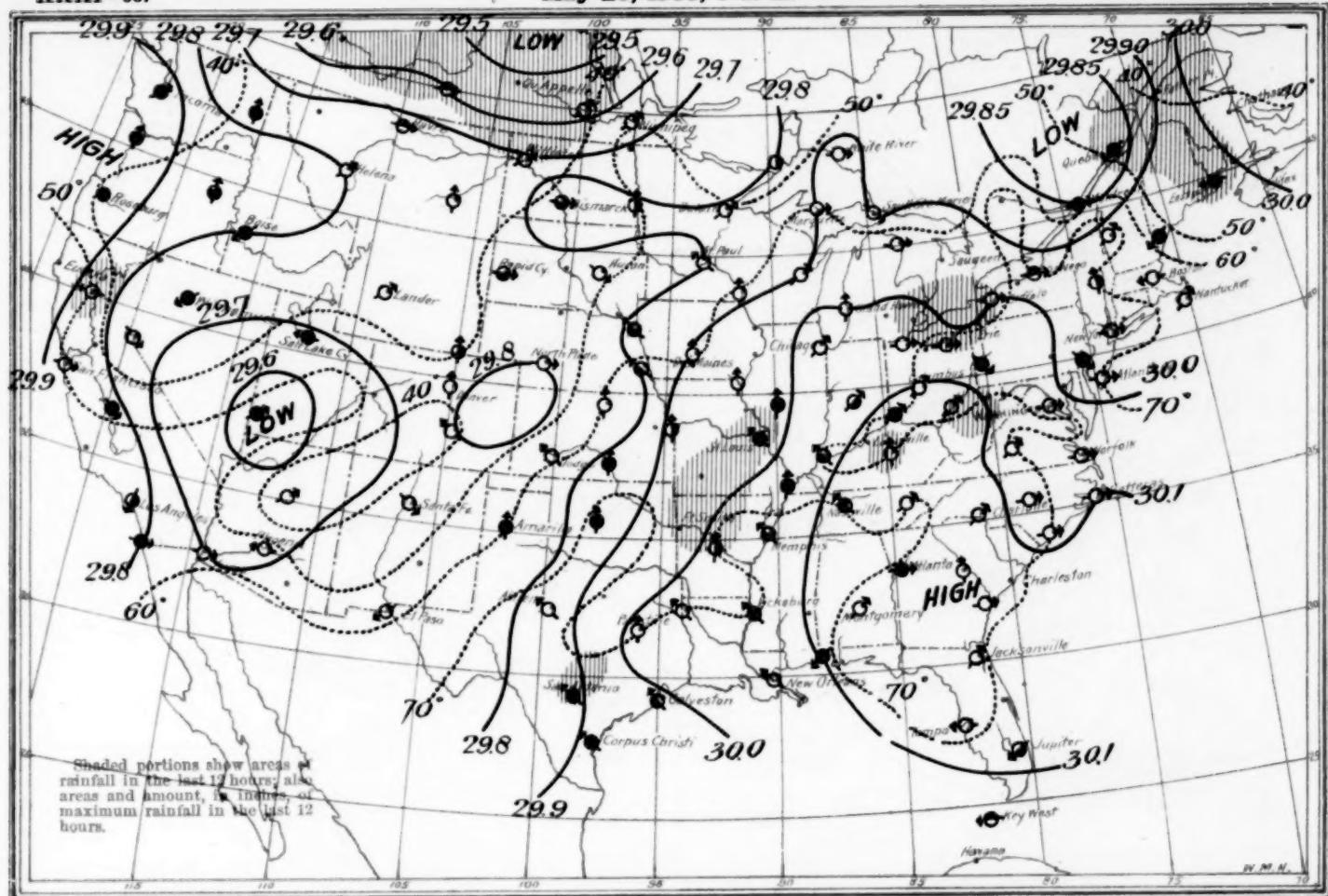


Chart XI. Daily Weather Maps.

May 20, 1903, 8 a. m.

XXXI-53.



May 20, 1903, 8 p. m.

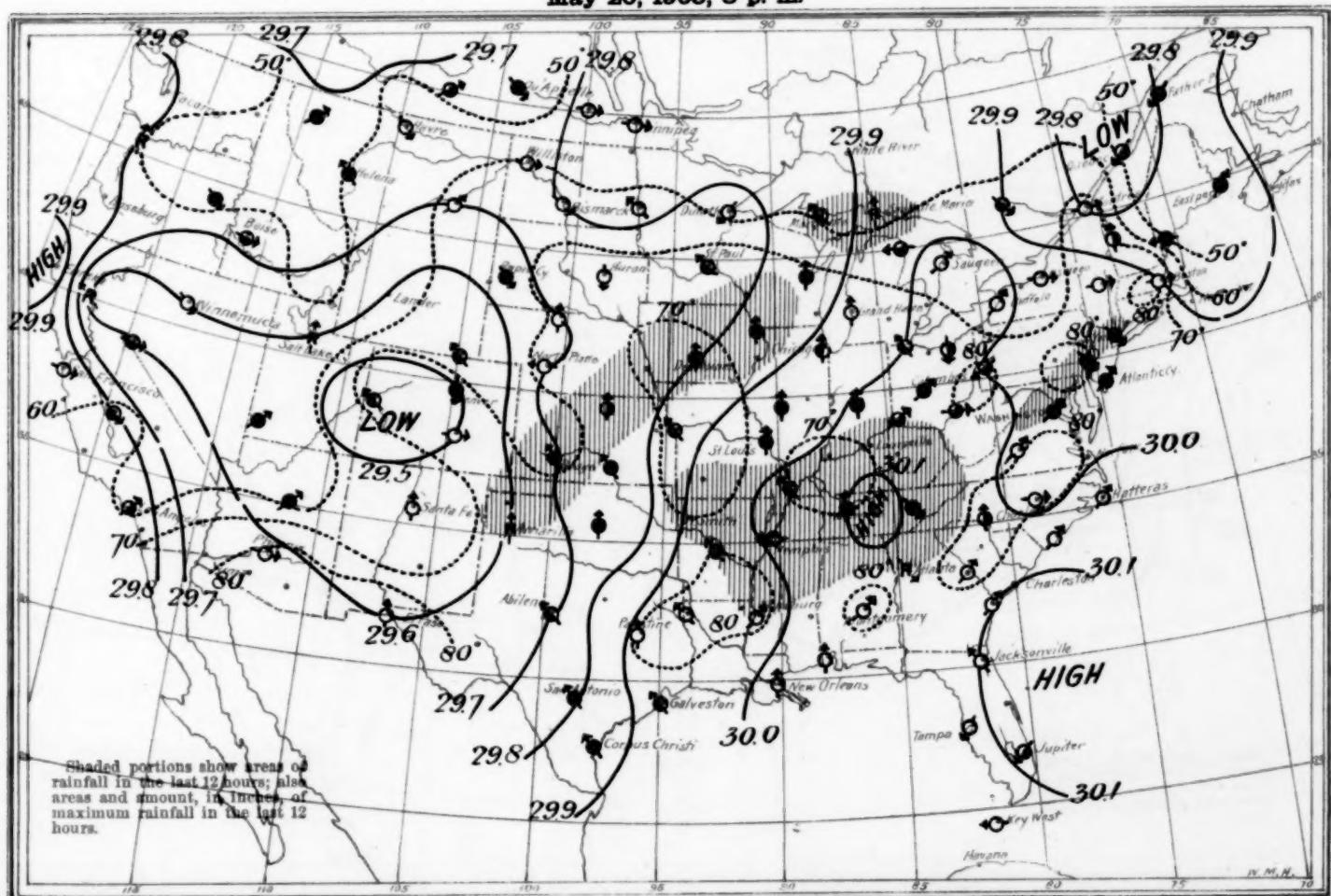
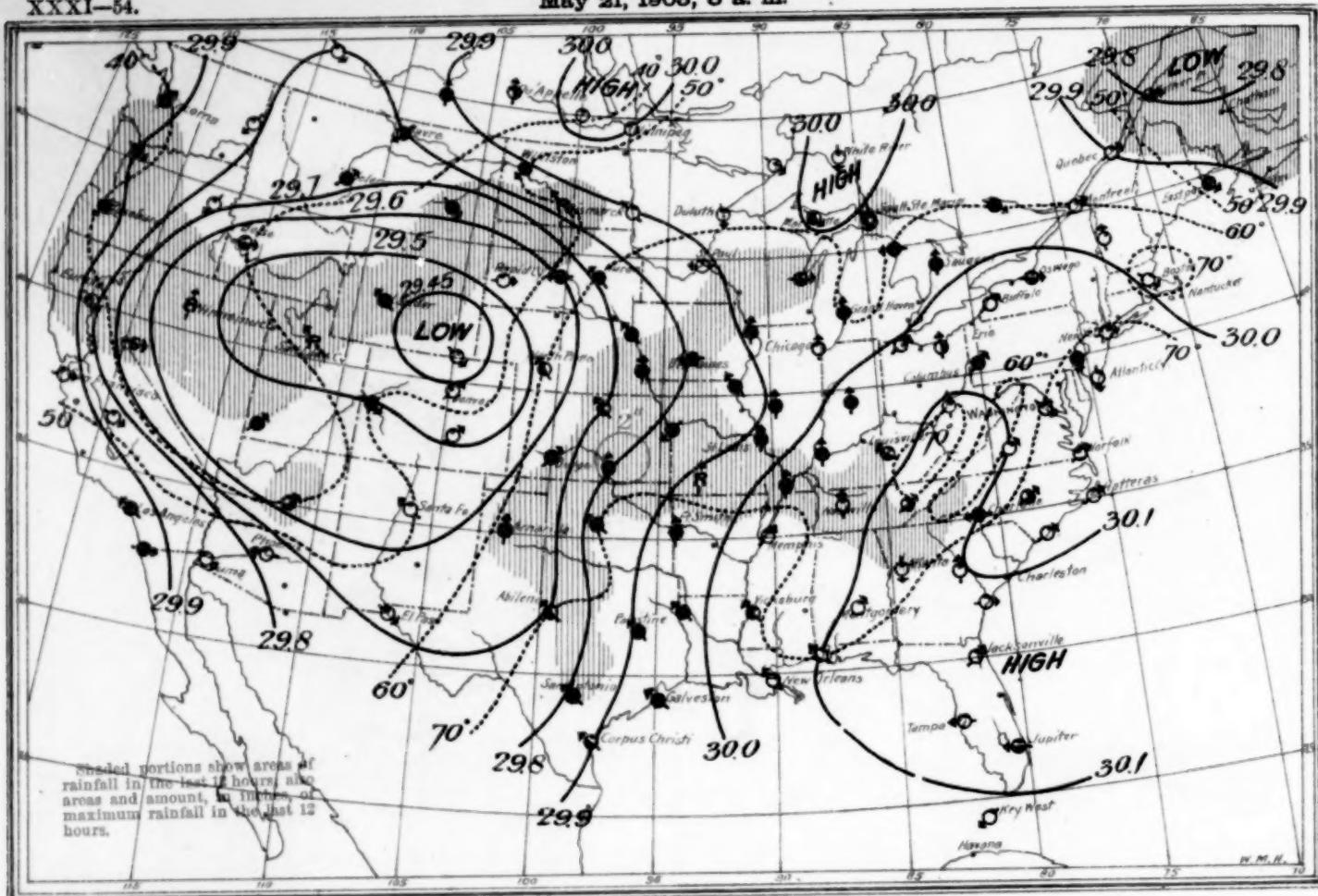


Chart XII. Daily Weather Maps.

May 21, 1903, 8 a. m.

XXXI-54.



May 21, 1903, 8 p. m.

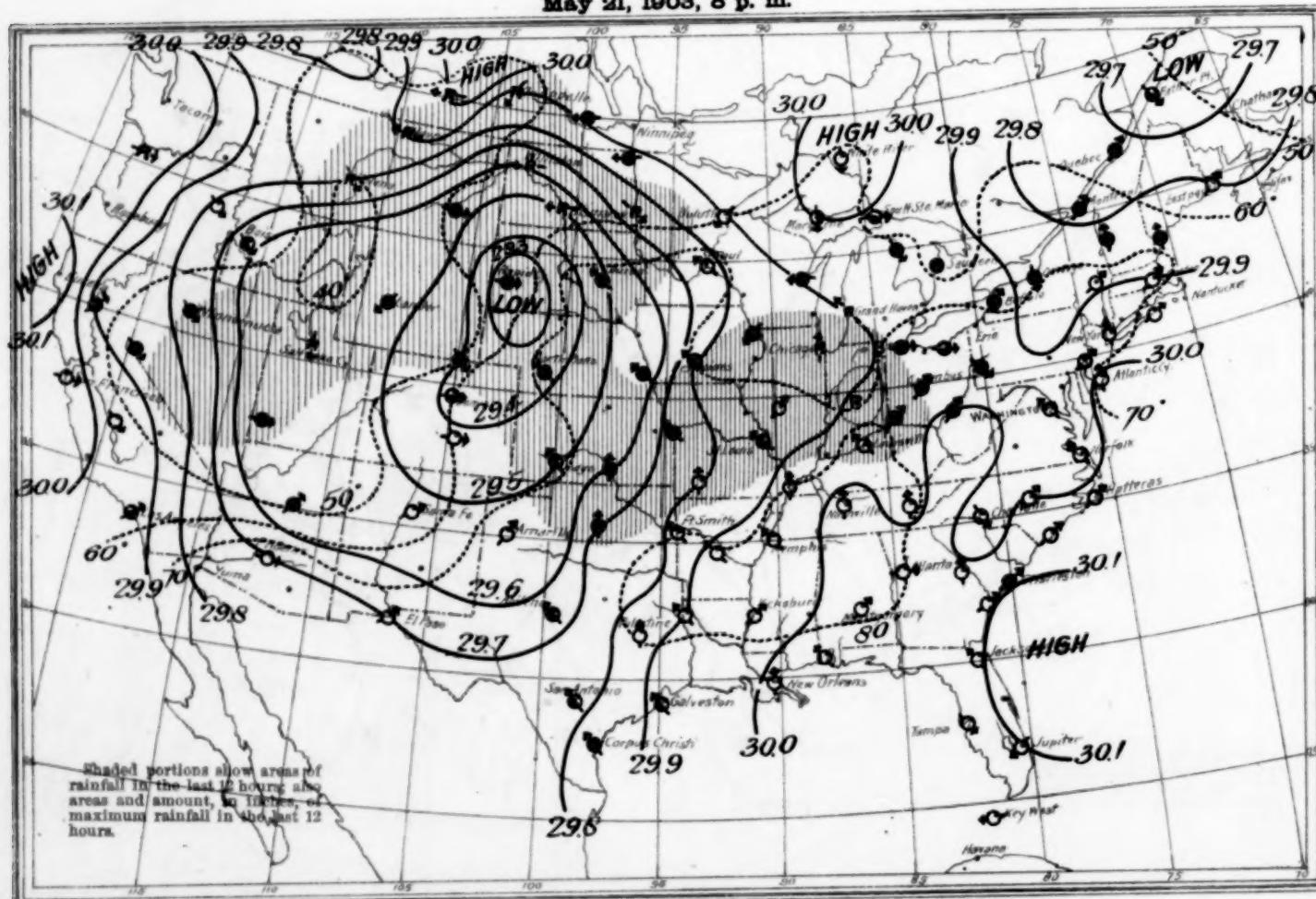
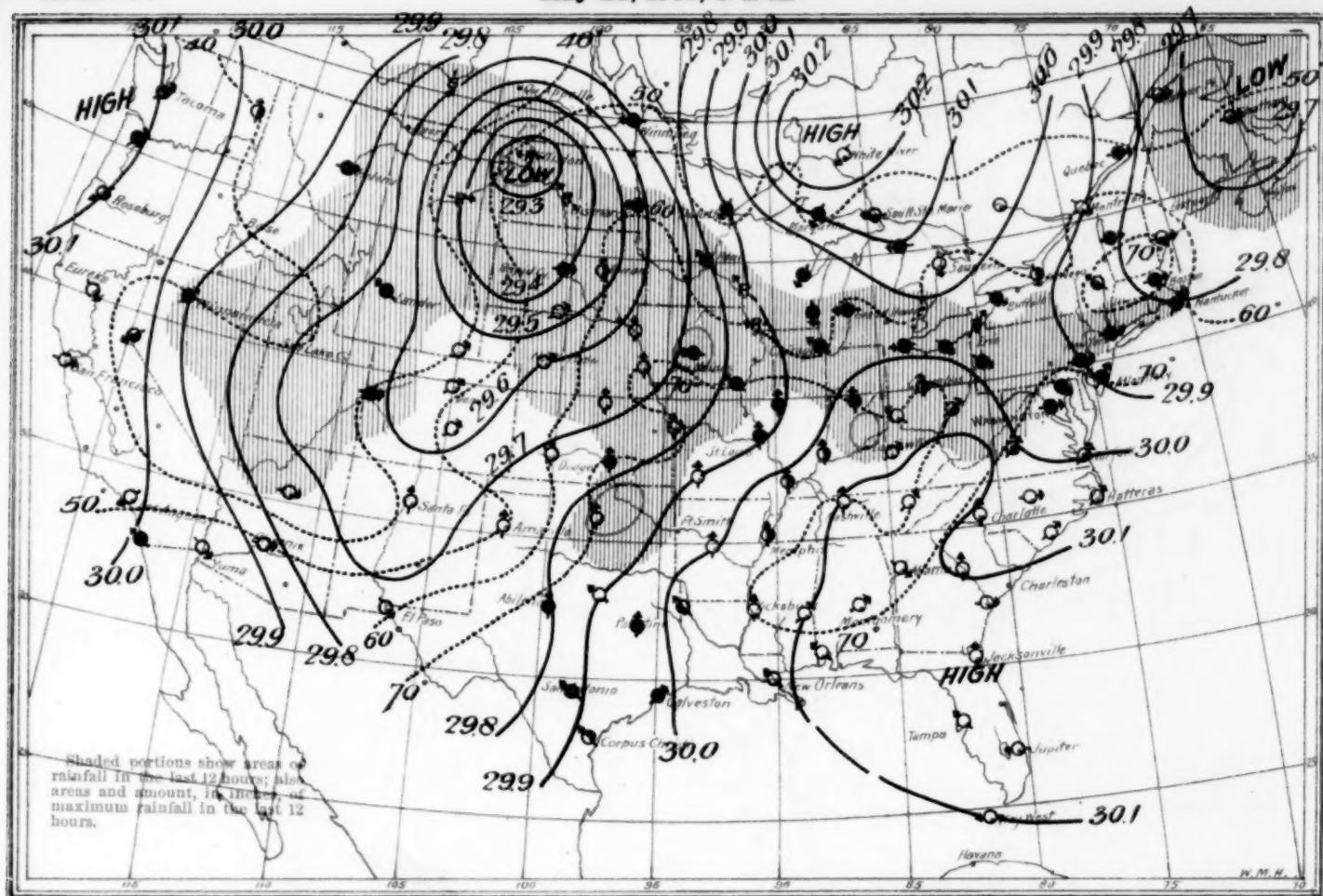


Chart XIII. Daily Weather Maps.
May 22, 1903, 8 a. m.

XXXI-55.



May 22, 1903, 8 p. m.

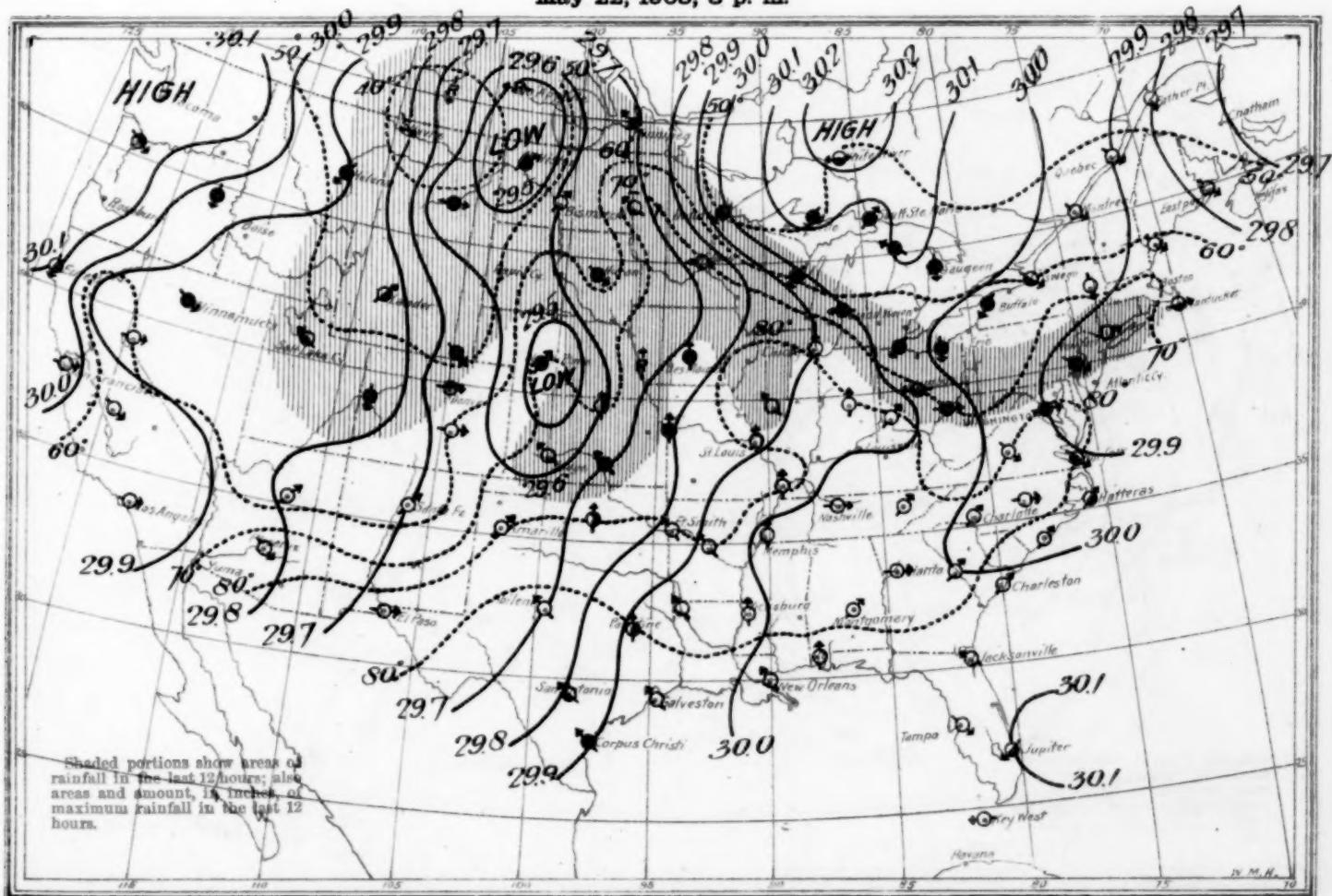
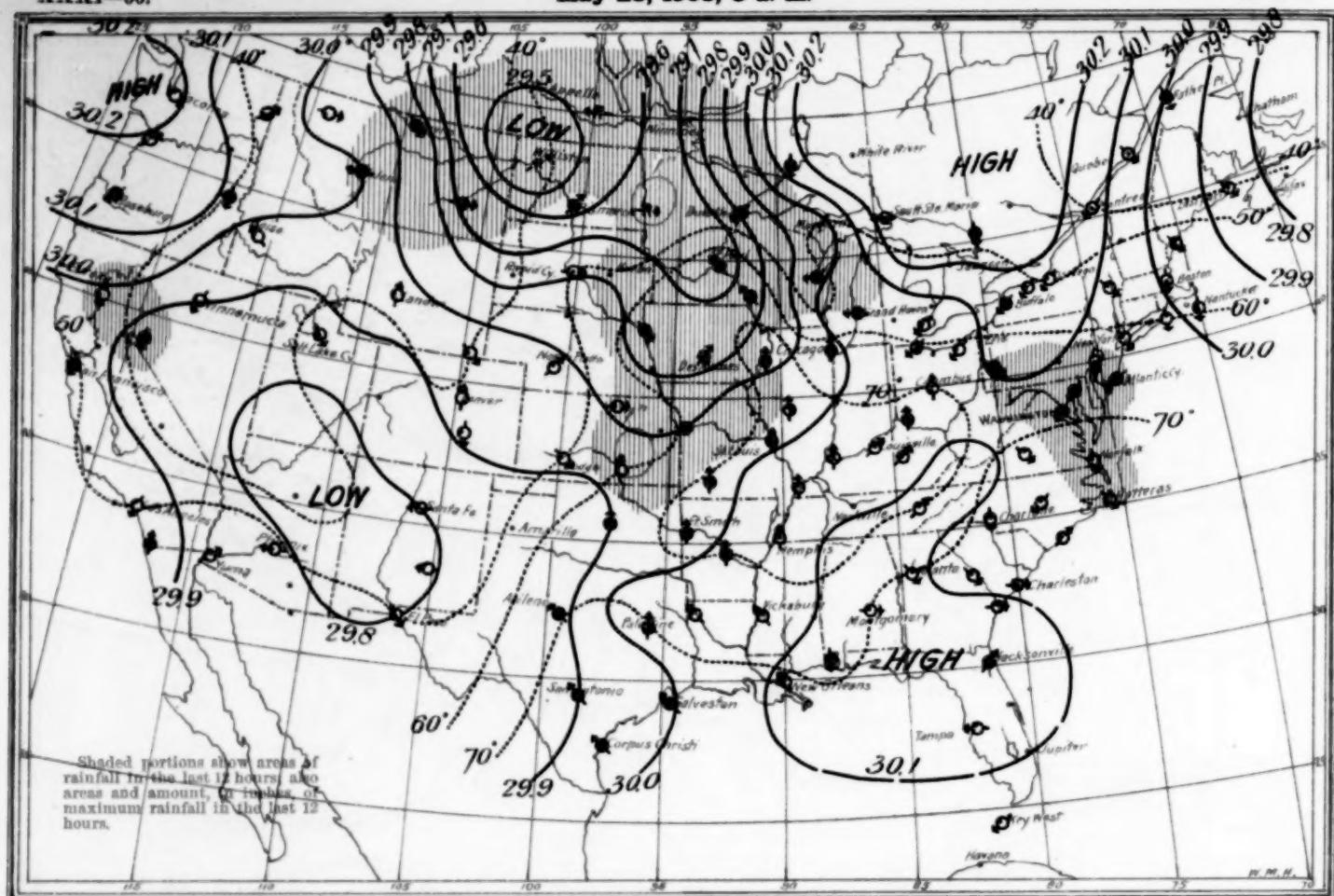


Chart XIV. Daily Weather Maps.

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May 23, 1903, 8 a. m.



May 23, 1903, 8 p. m.

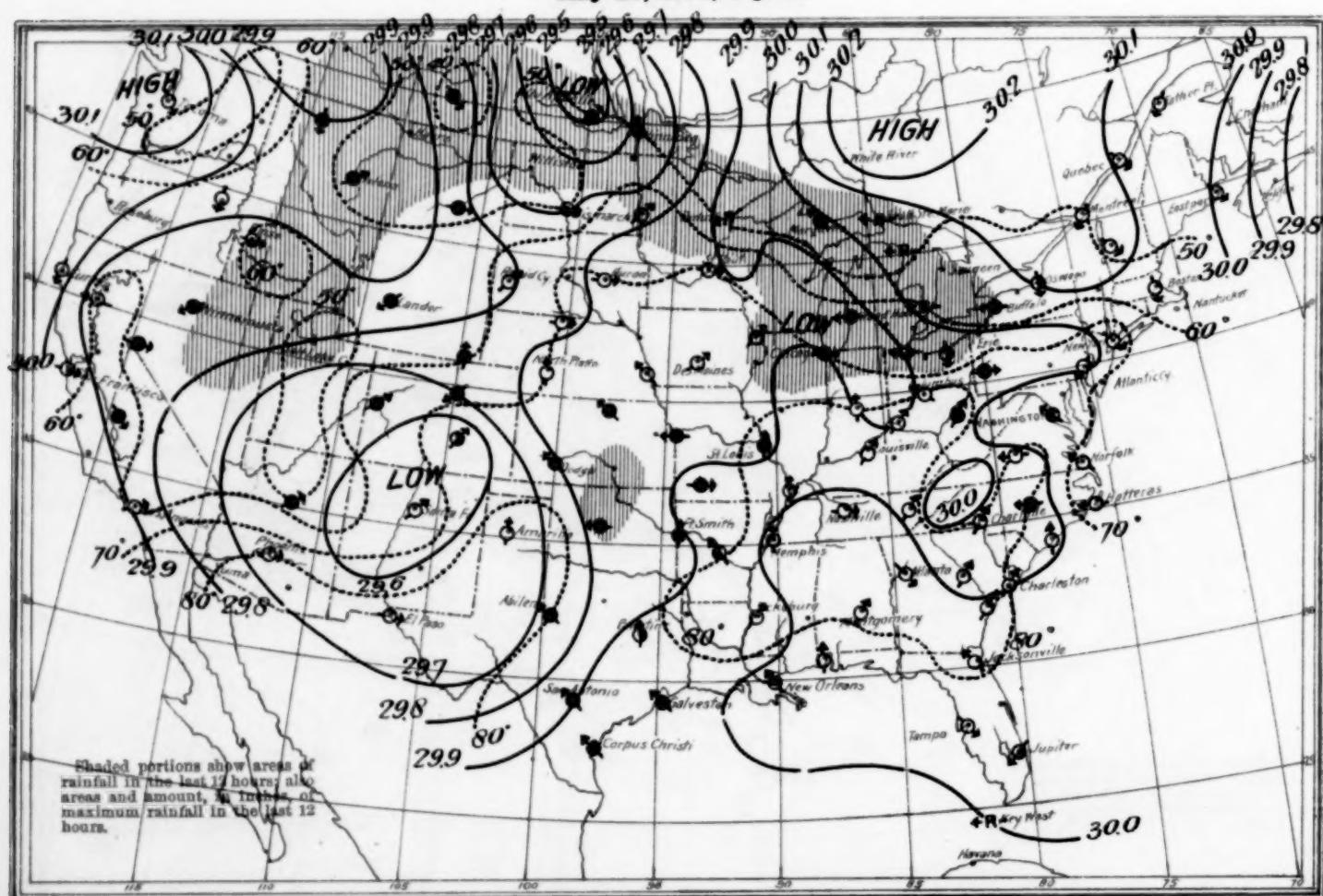
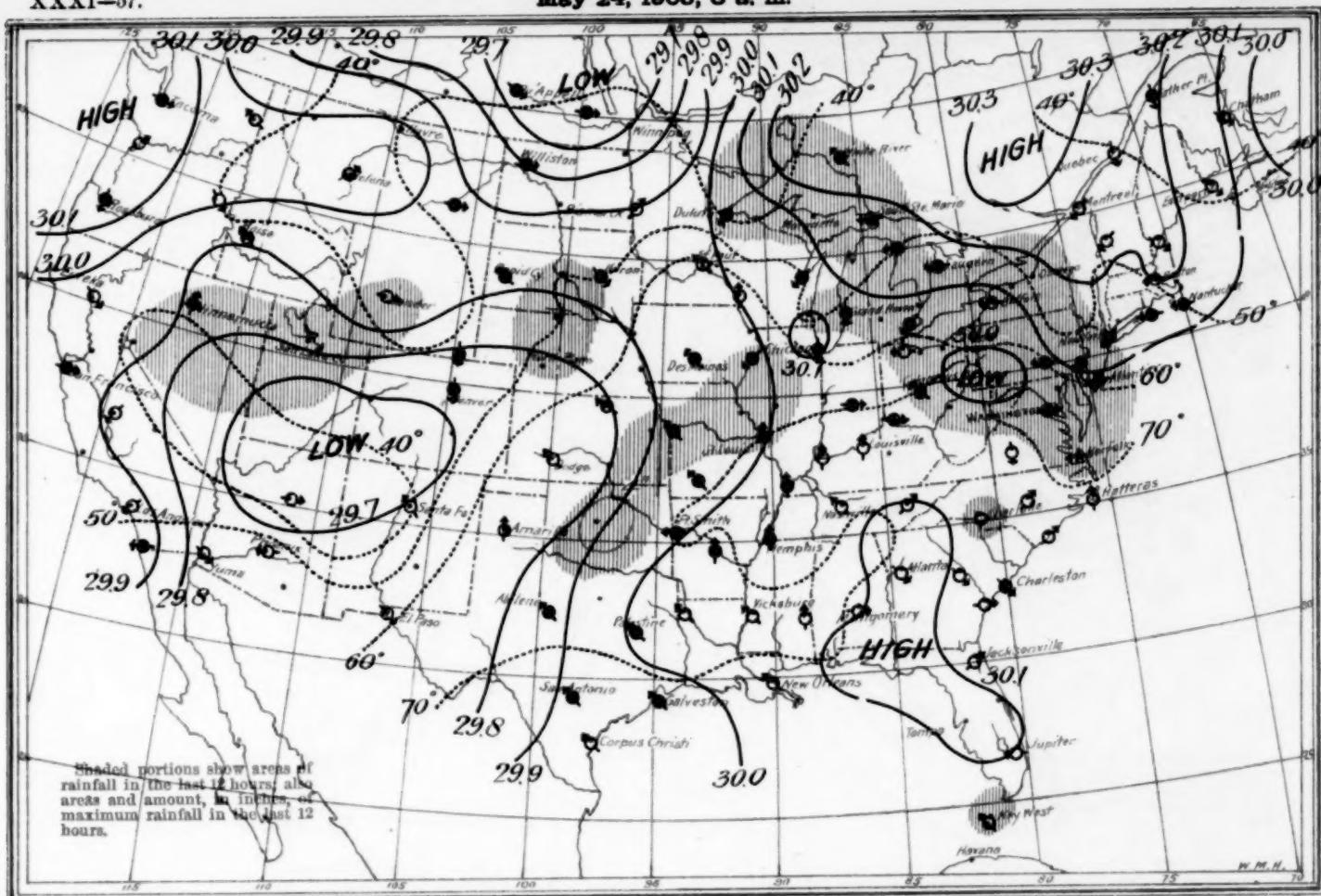


Chart XV. Daily Weather Maps.

May 24, 1903, 8 a. m.

XXXI-57.



May 24, 1903, 8 p. m.

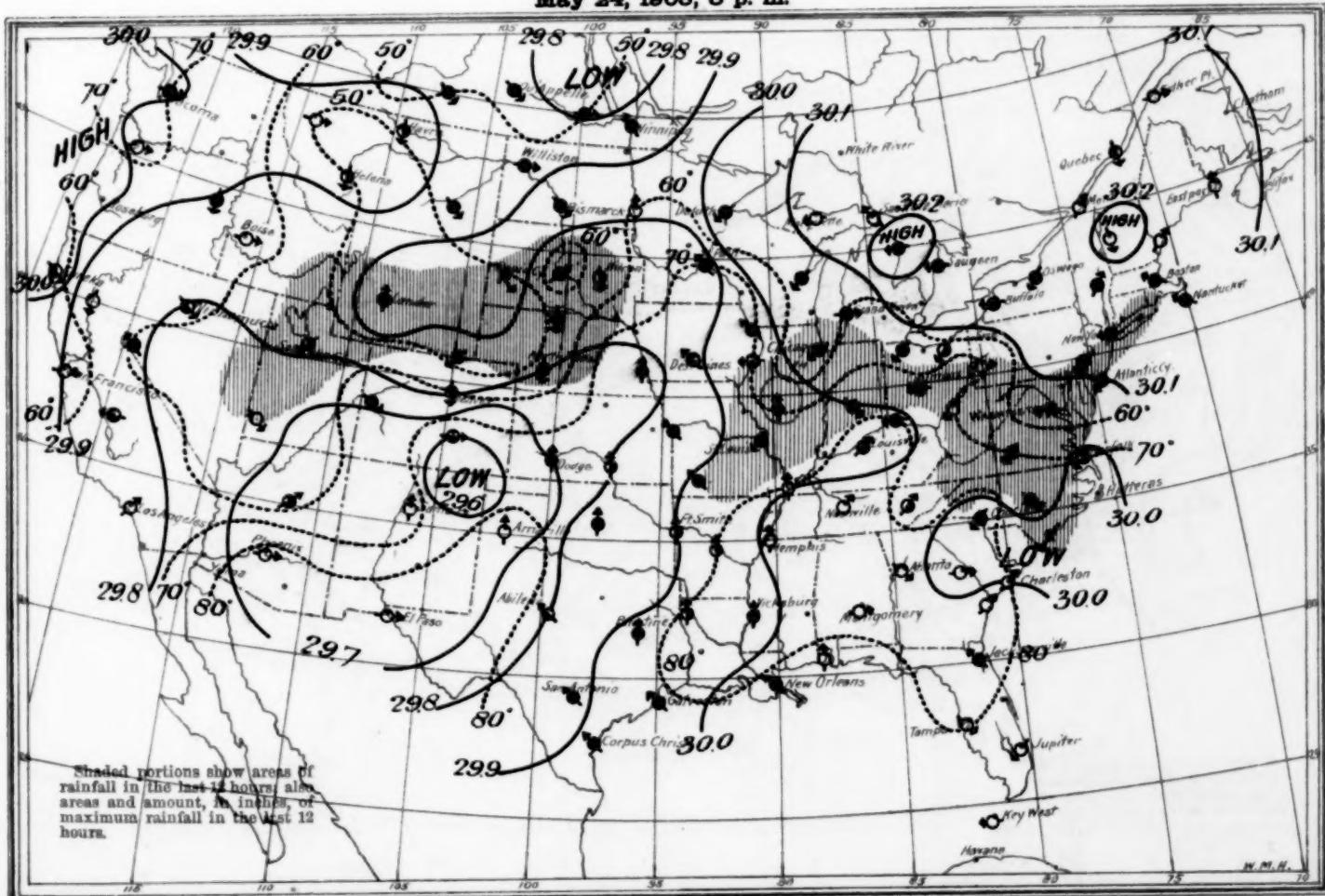
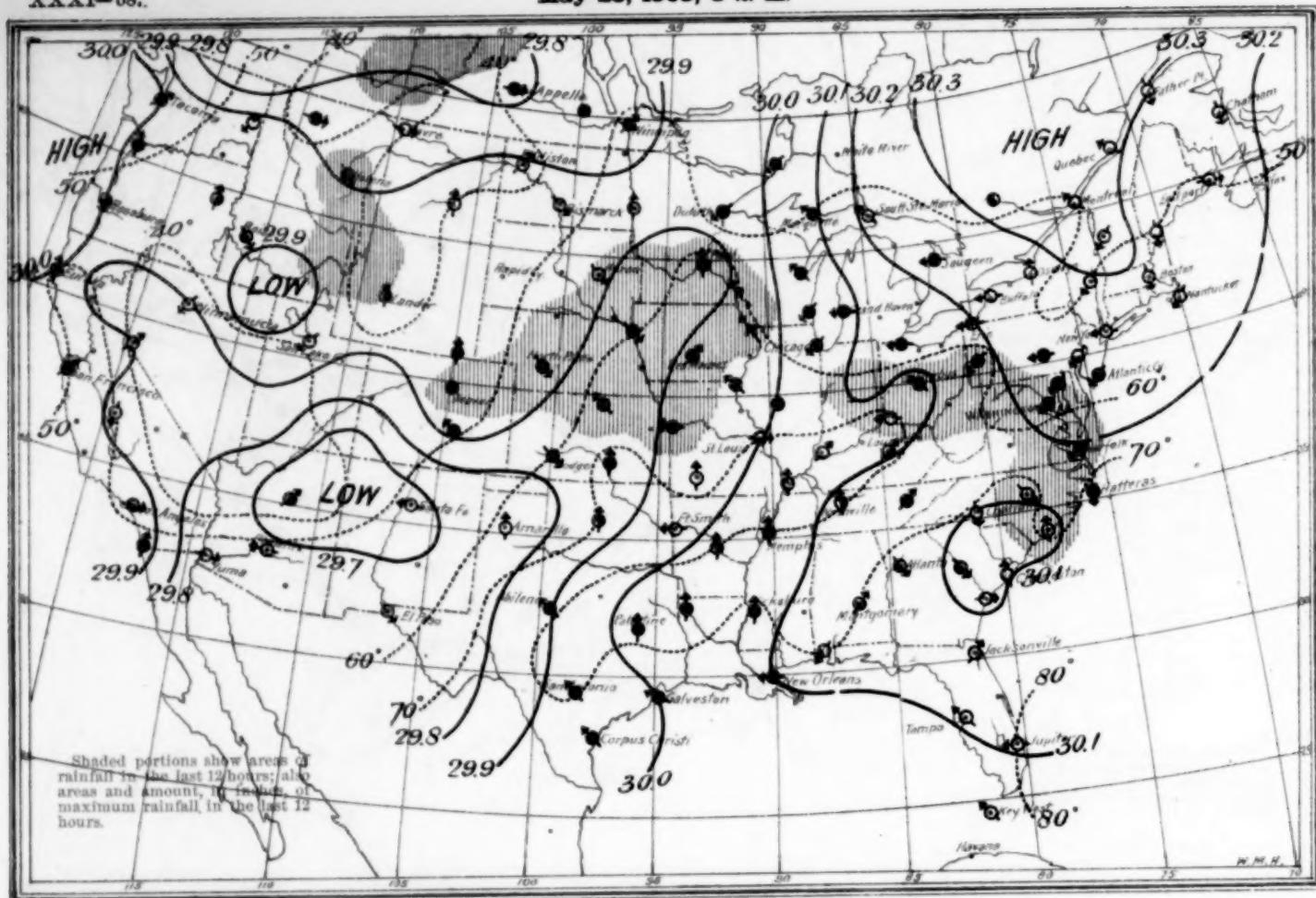


Chart XVI. Daily Weather Maps.

XXXI-58.

May 25, 1903, 8 a. m.



May 25, 1903, 8 p. m.

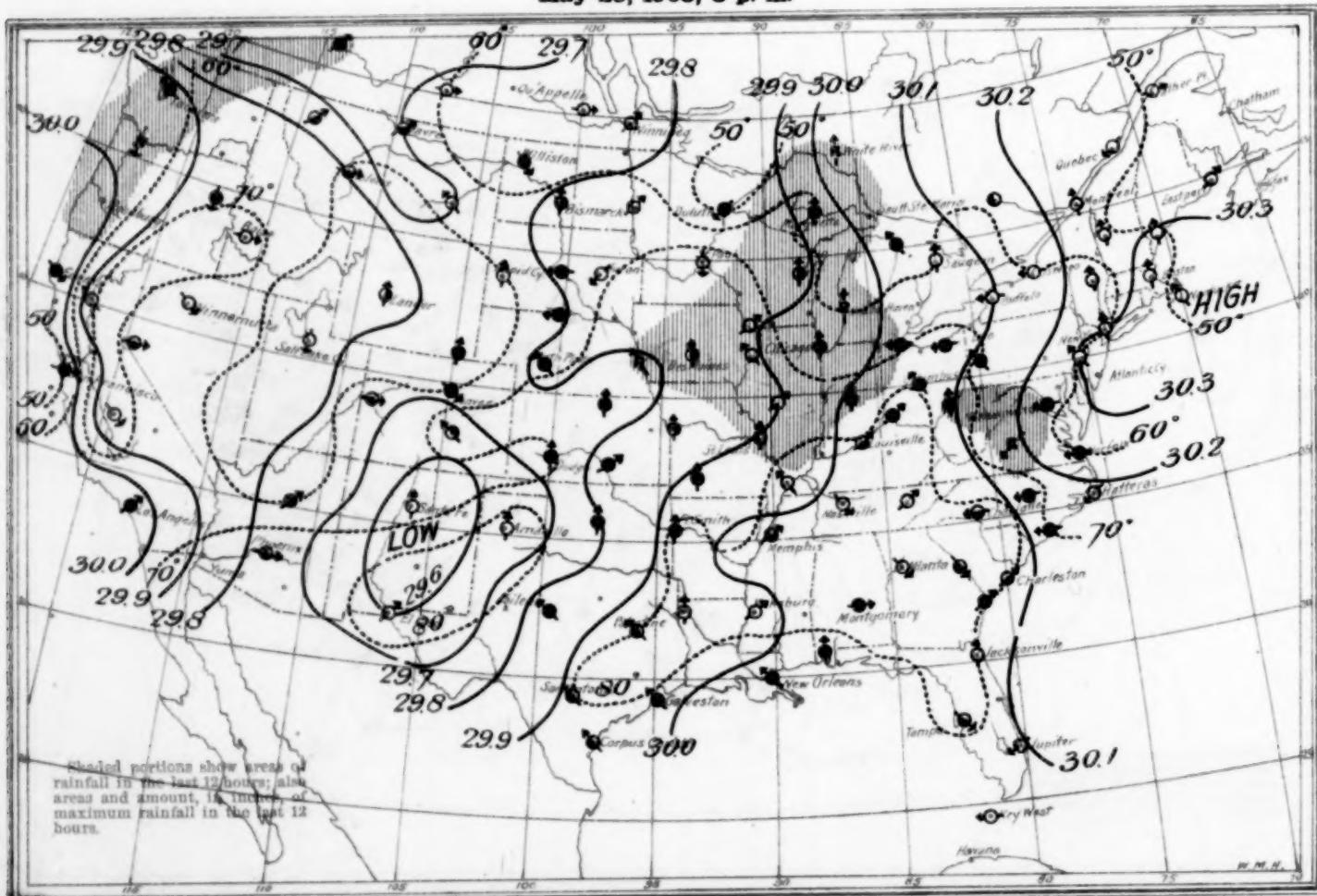
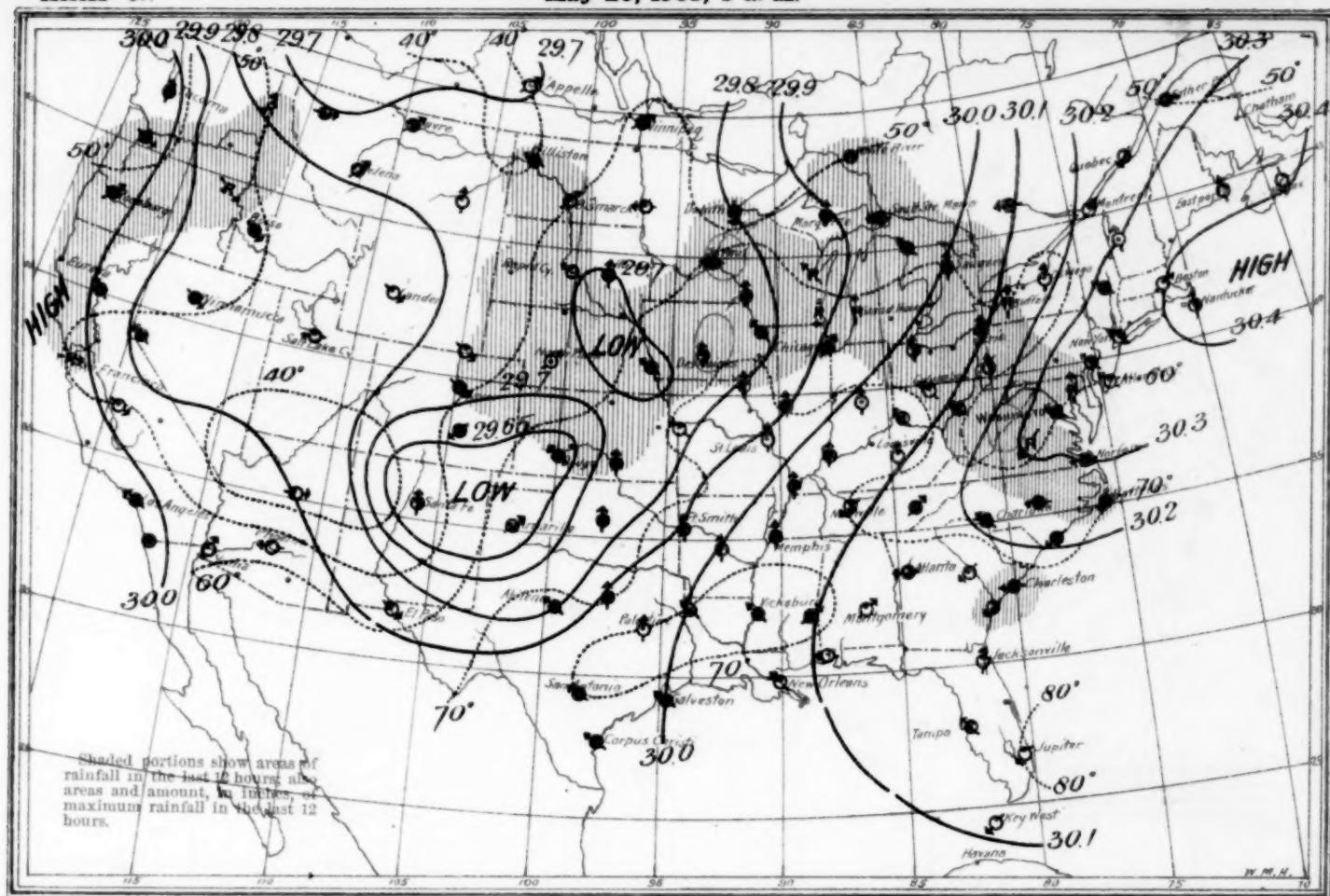


Chart XVII. Daily Weather Maps.

XXXI-50.



May 26, 1903, 8 p. m.

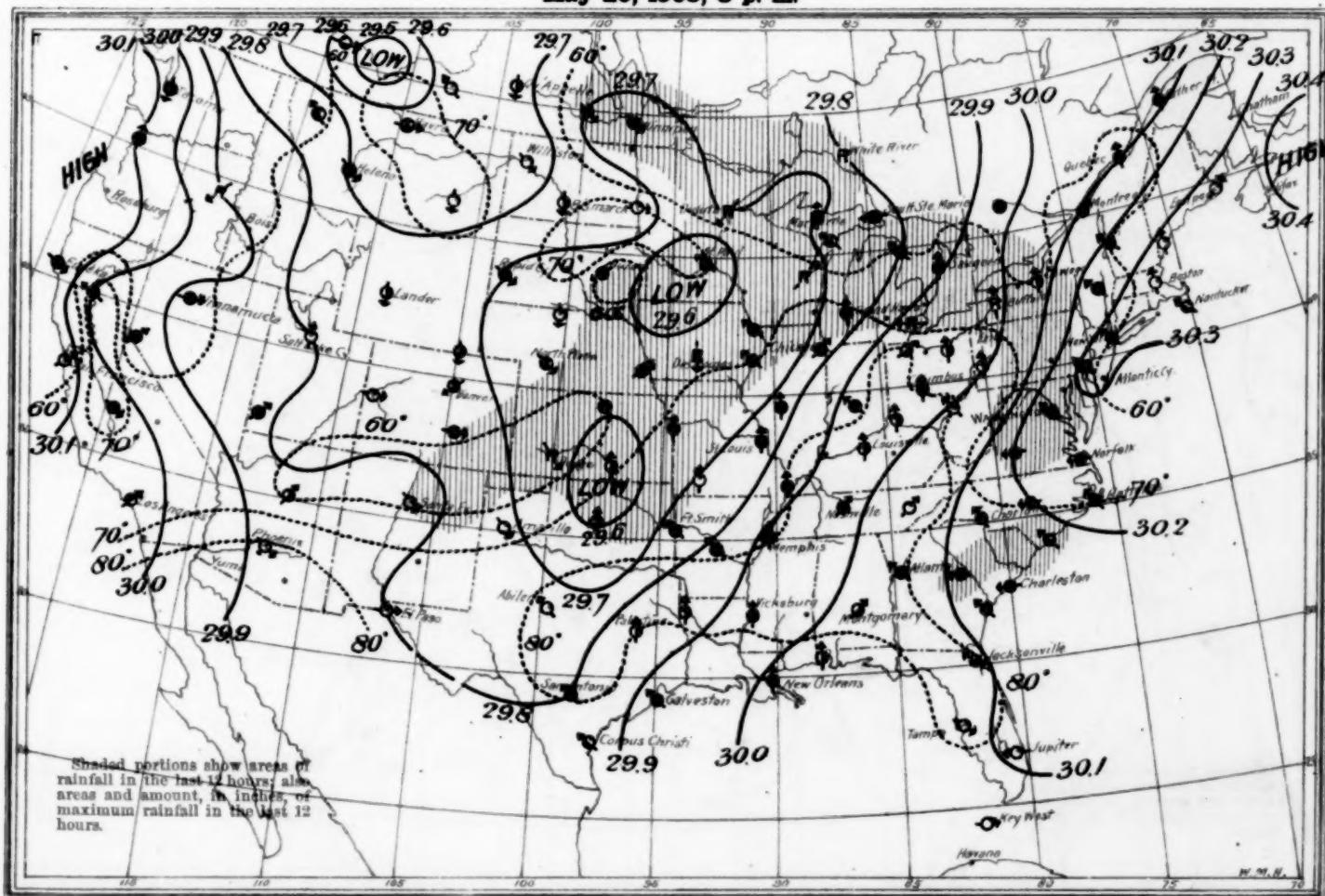
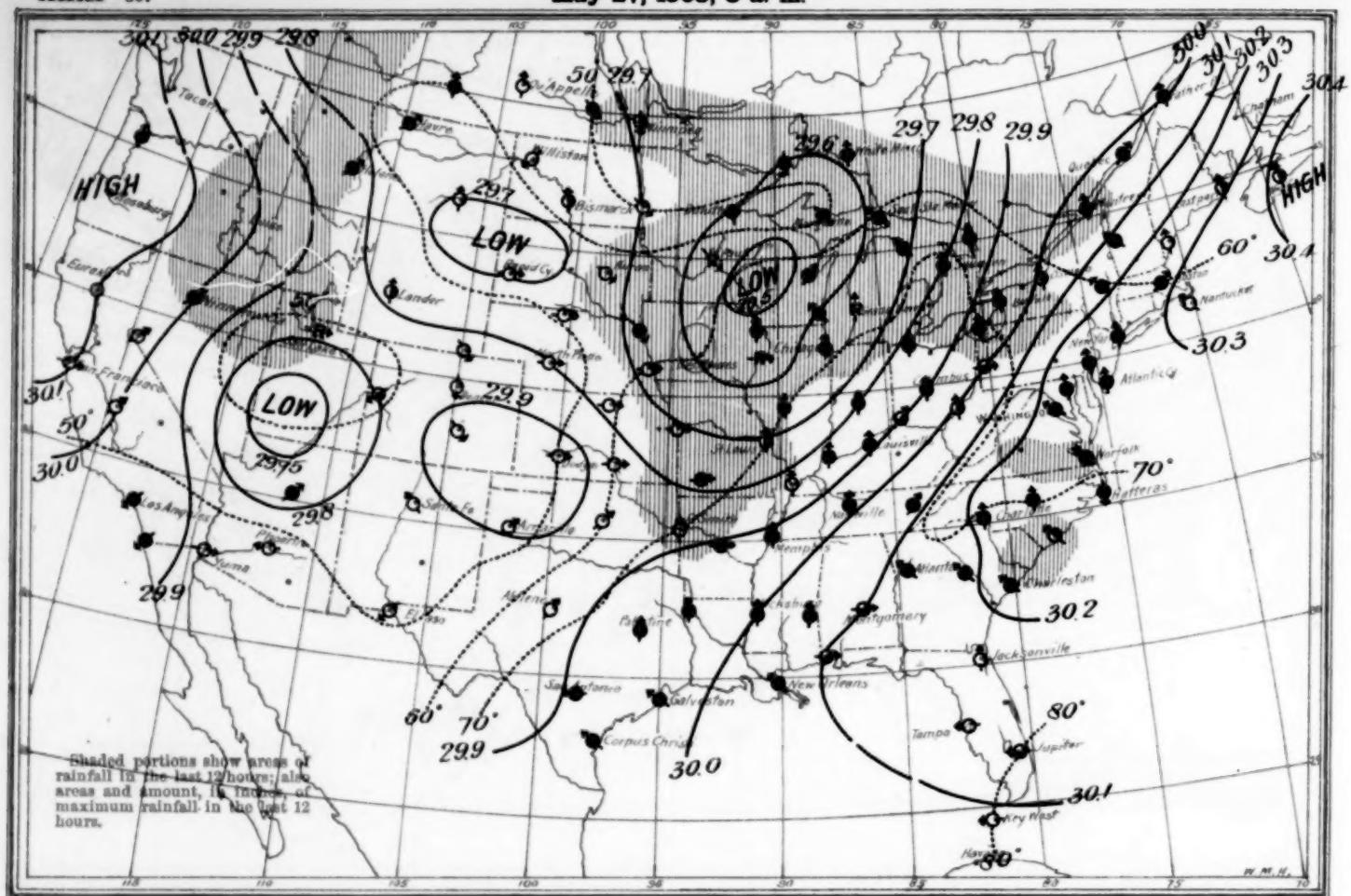


Chart XVIII. Daily Weather Maps.
May 27, 1903, 8 a. m.

XXXI-60.



May 27, 1903, 8 p. m.

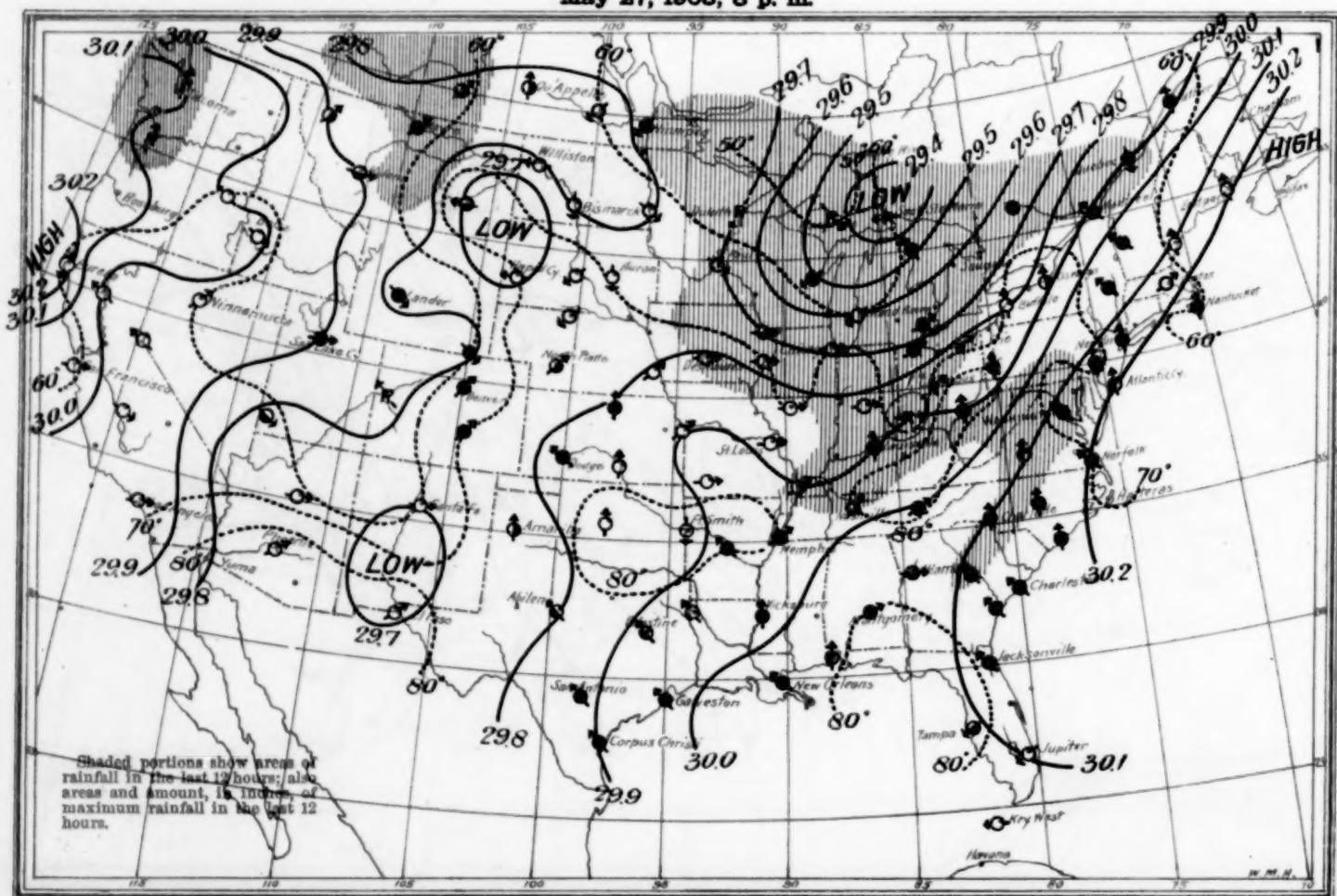
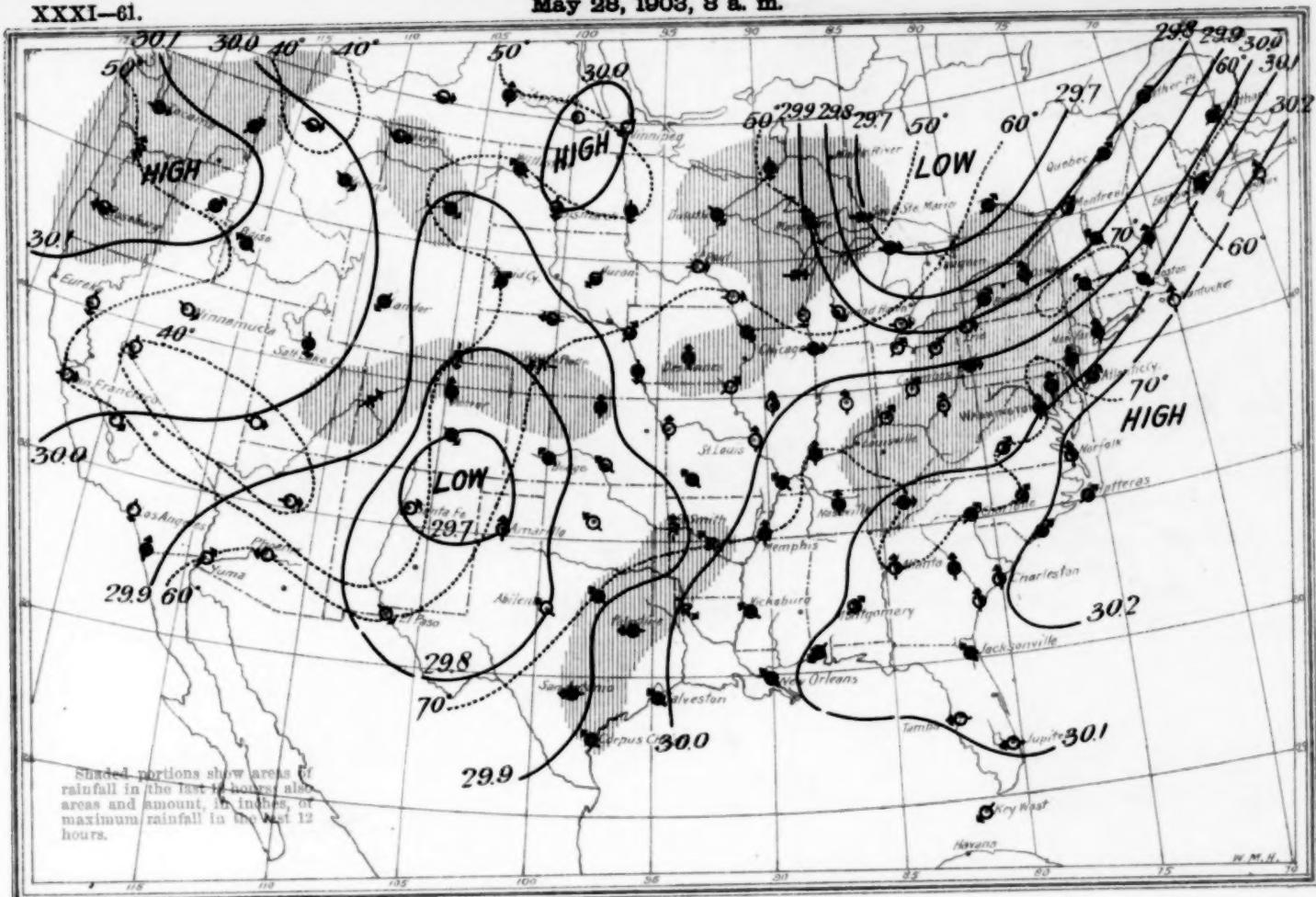


Chart XIX. Daily Weather Maps.

May 28, 1903, 8 a.m.

XXXI-61.



May 28, 1903, 8 p. m.

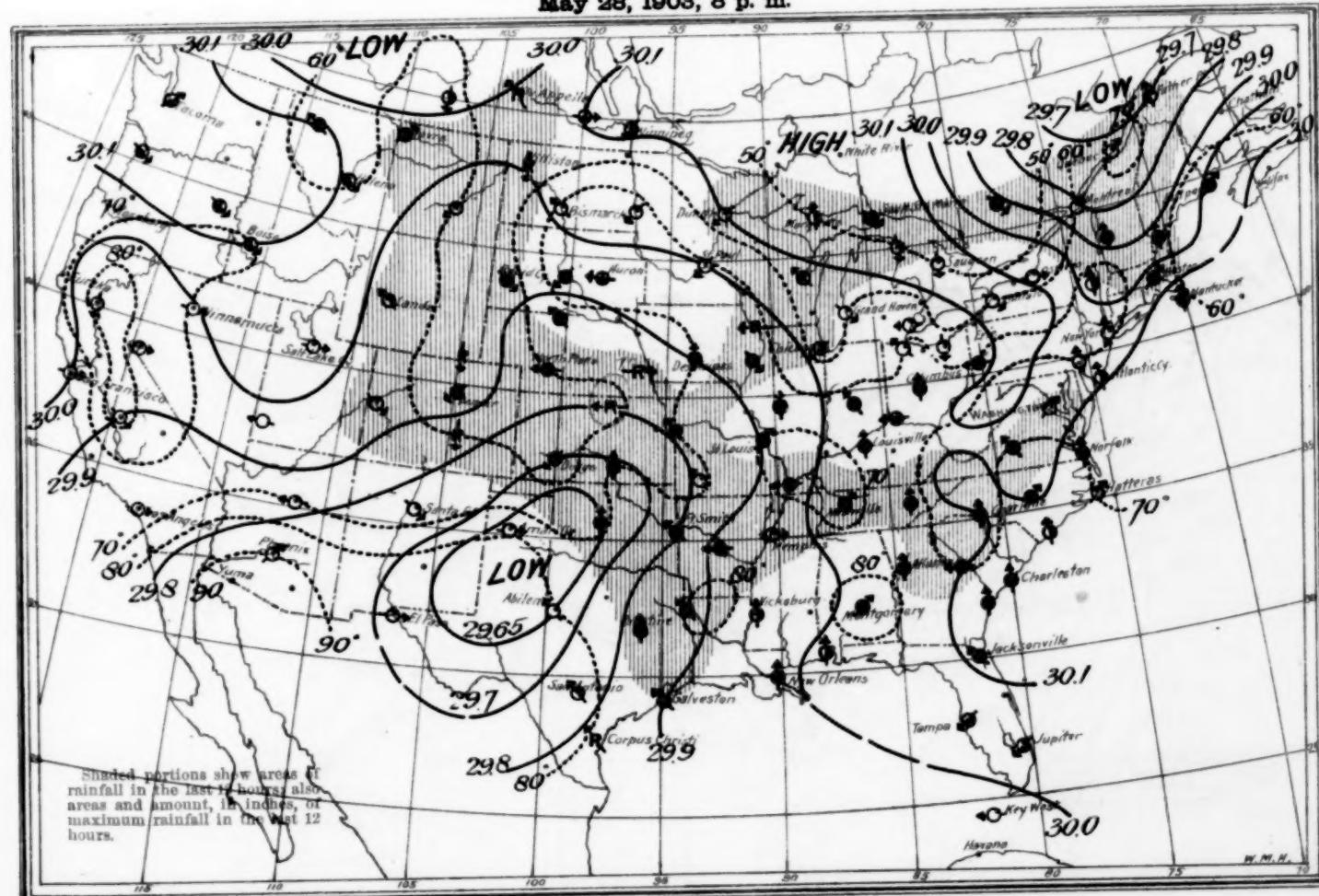
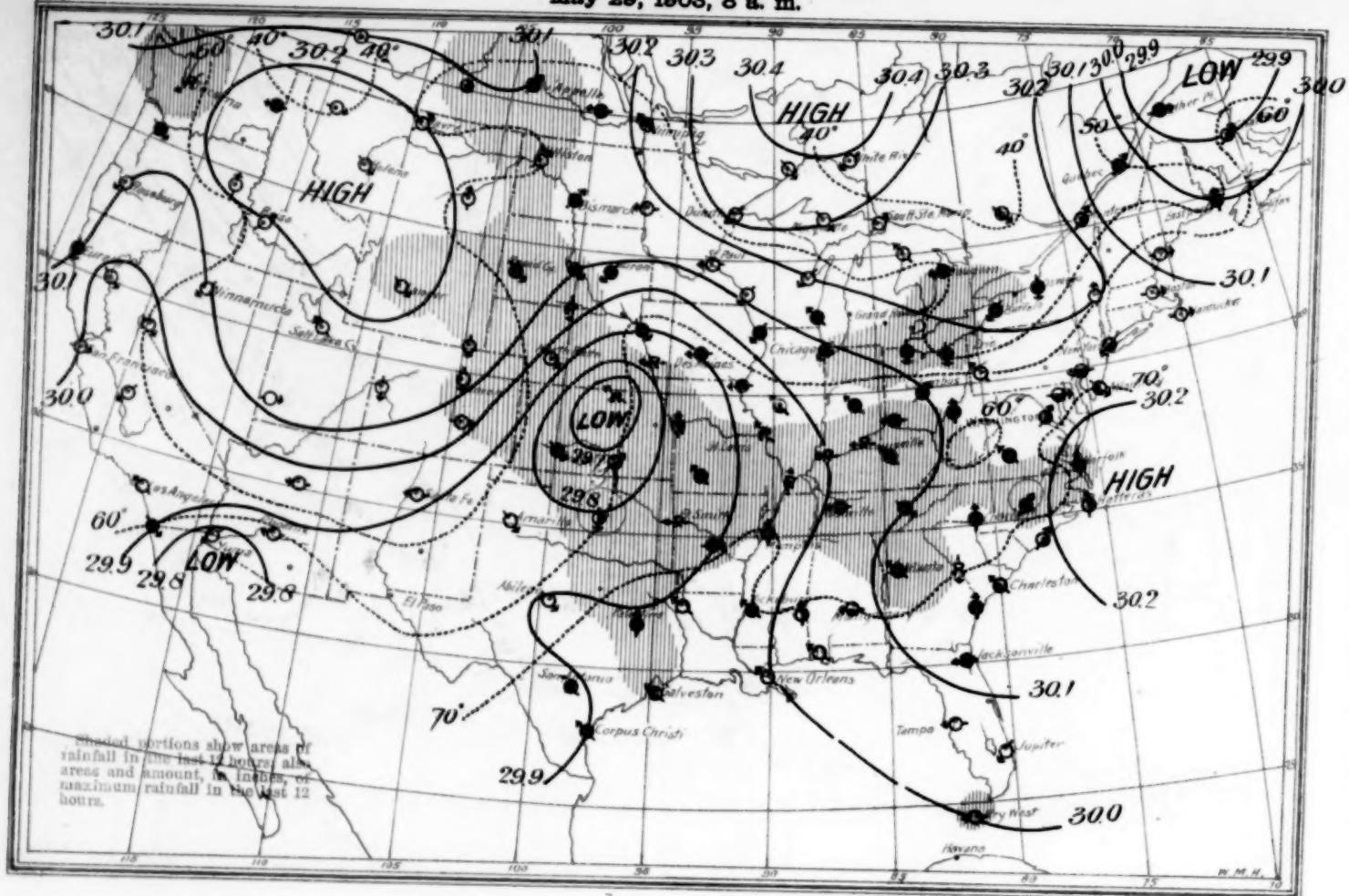


Chart XX. Daily Weather Maps.
May 29, 1903, 8 a. m.



May 29, 1903, 8 p. m.

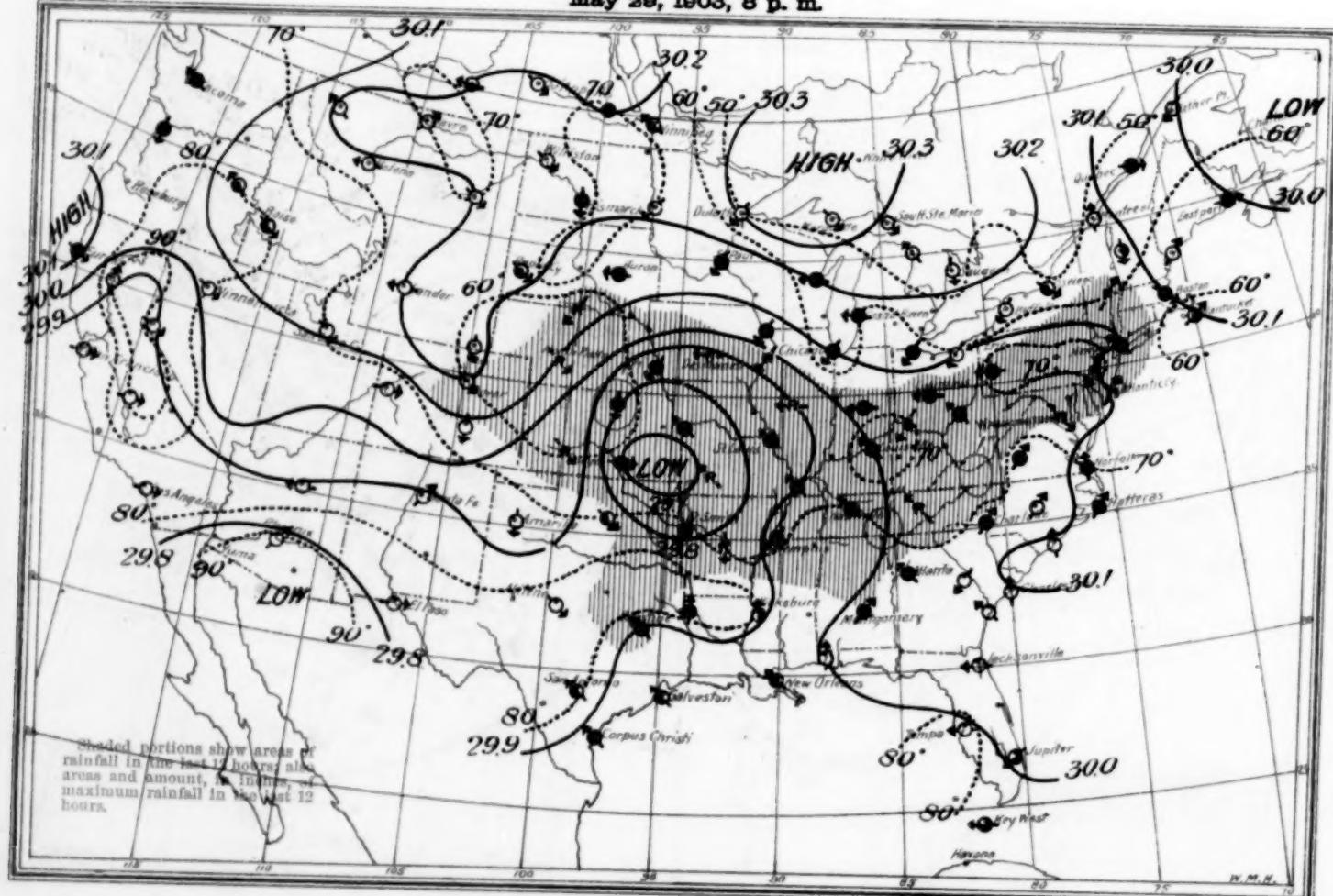
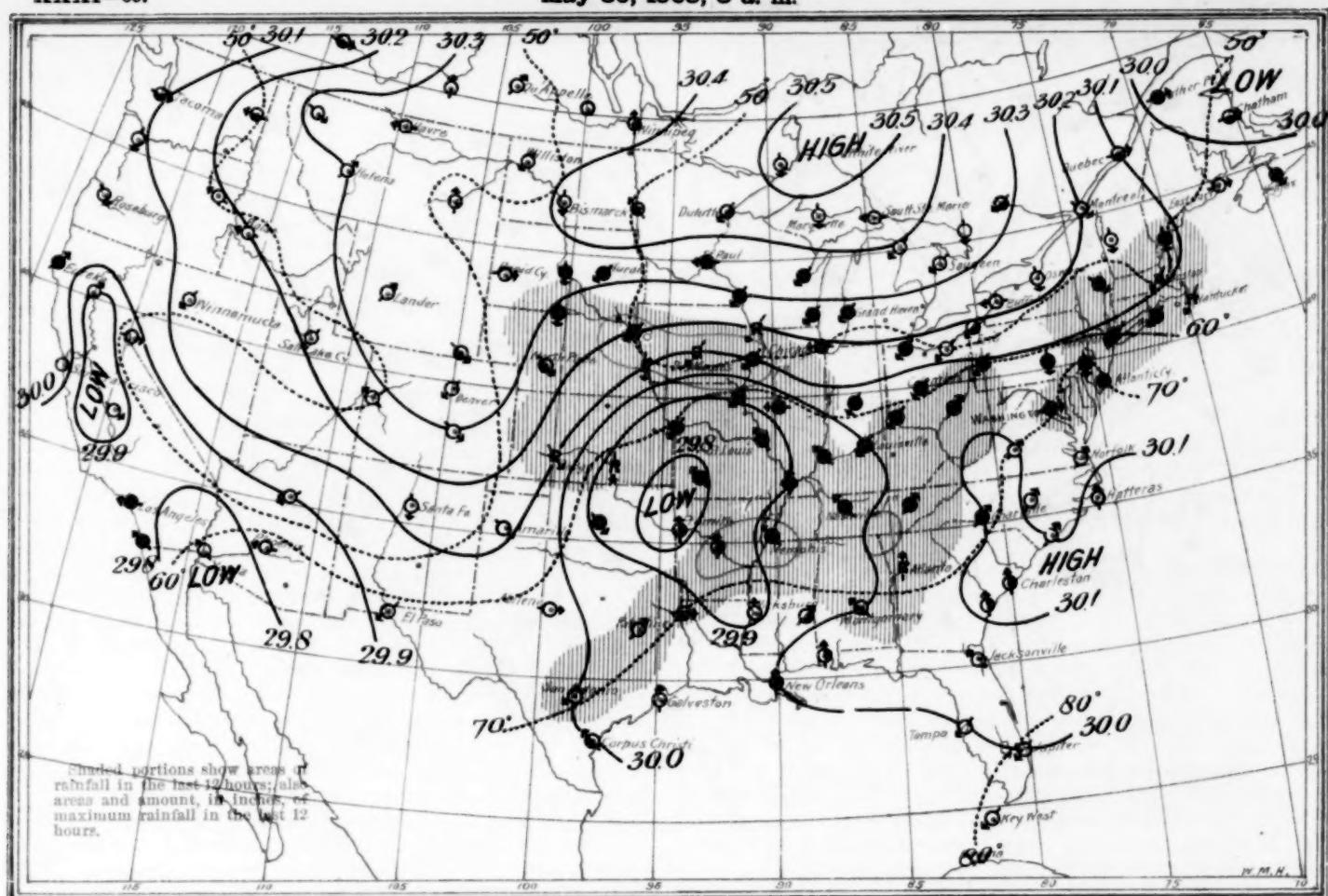


Chart XXI. Daily Weather Maps.
May 30, 1903, 8 a. m.

XXXI-63.



May 30, 1903, 8 p. m.

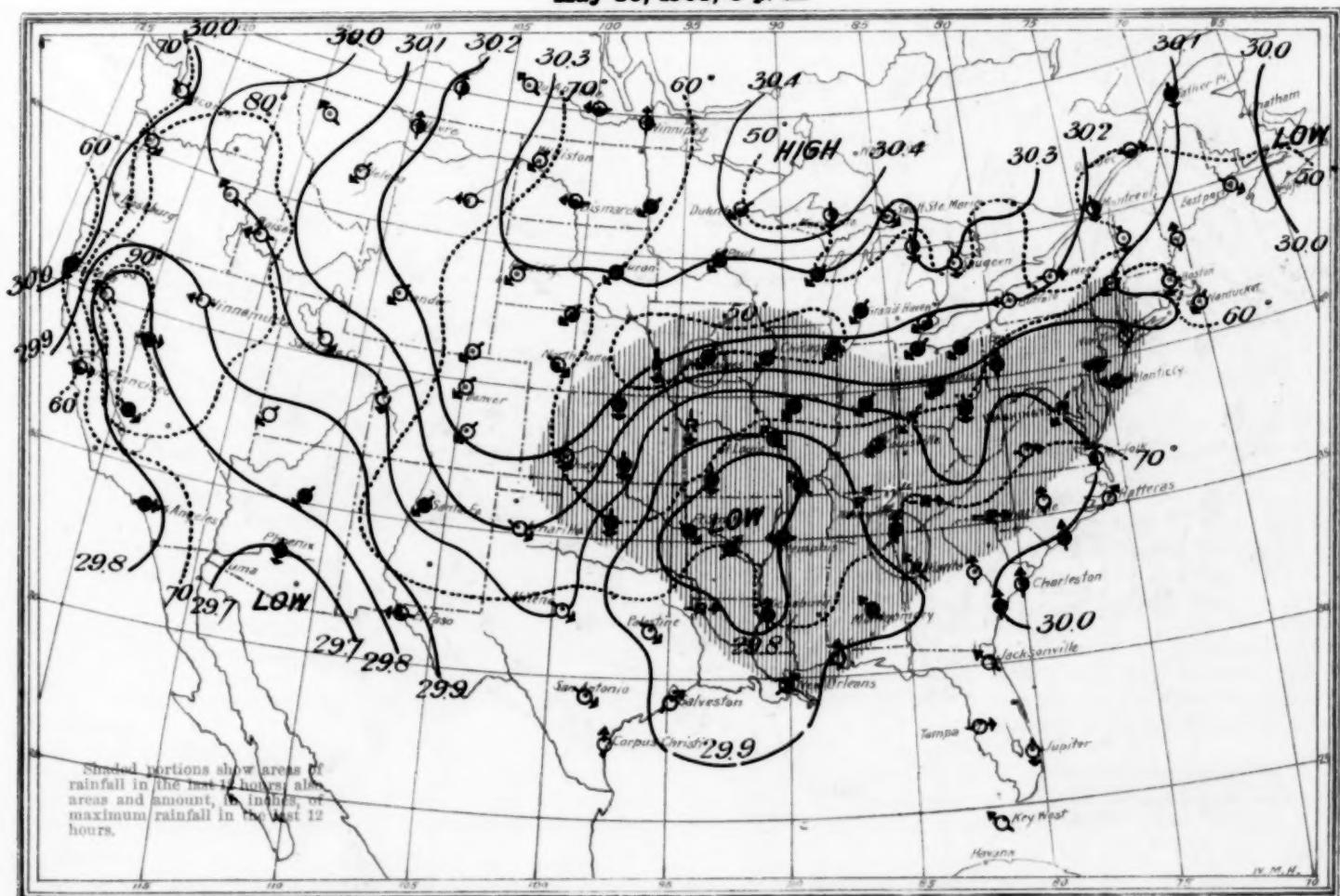
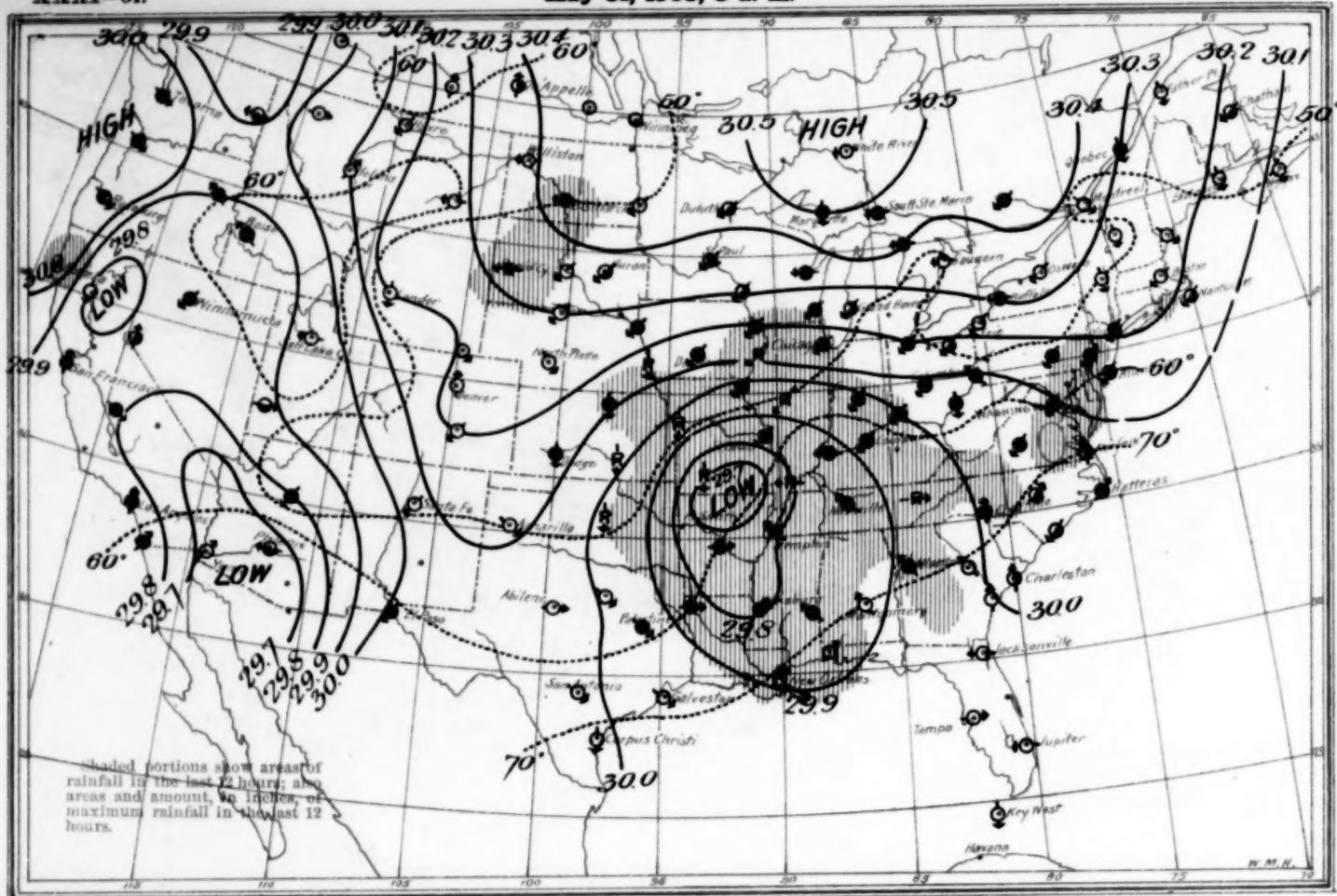


Chart XXII. Daily Weather Maps.
May 31, 1903, 8 a. m.

XXXI-64.



May 31, 1903, 8 p. m.

